MICROVITEC
SERIES

3

SERVICE
MANUAL

SERVICE MANUAL

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1984

MICROVITEC
PLC

SERVICE MANUAL

SERIES – 3
COLOUR DISPLAY MONITORS

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COLOUR DISPLAY MONITORS

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INFORMATION BULLETIN

As a user of our service manual, you are obviously involved in the servicing of Microvitec Monitors.

We would like to introduce you to the series of one-day service training courses which are held at our Bradford factory.

These courses are intended to introduce engineers who have experience of field repairs on T.V. or microcomputer products, to Microvitec Monitors.

If you are interested in attending one of our service training courses, please contact:

MICROVITEC PLC
Customer Services Department
Bolling Road
Bradford BD4 7TU
W. Yorkshire
or **telephone (0274) 390011**

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INTRODUCTION

INTRODUCTION

SERIES 3 MONITORS

The contents of this manual are divided into several sections, and deal with Monitors in the SERIES 3 product range.

As described following, we take a look in some detail at the various sections in the Manual and explain how they are to be used to their best advantage. The Manual is intended to support the servicing of SERIES 3 Monitors.

SPECIFICATIONS

The first specification list (Models 1431/1432) contains a full specification and is generally typical of SERIES 3 Monitors; subsequent lists contain only the areas that differ from the first list. For example; the mains supply is 180-265 volts, ~ 48-64 Hz (excluding 110 volt models). This will only be given on the first specification list. Therefore, unless otherwise stated, refer to specification 1 (Models 1431/1432) for other similar specified parameters.

FACTORY PRE-SET ADJUSTMENTS

Some of these adjustments are very critical, not only from an operational point but also from a safety point. The manufacturer recommends that you read and understand the section fully before making any adjustments.

All pre-set adjustments are included in this section. You are given the prefix for example: Field Linearity VR312. If you are not sure of the location of any pre-set (or component) then you should refer to the section containing PCB or CRT base panel layouts. Once you have located the pre-set, you are then told what effect the adjustment will have on the display.

REMOVAL/INSTALLATION (MECHANICAL DETAIL)

This section gives information (with text and illustrations) on how to remove and replace major service items such as: CRT, Main PCB and Tripler etc.

DESCRIPTION AND OPERATION

These sections will help you to understand the design concept of the Microvitec SERIES 3 Monitor. They provide detailed descriptions of each part of the circuit. For example; Line Timebase, Field Timebase etc. It is important that you read these sections for a full understanding of the monitor's working and of the fault isolation and repair procedures listed.

CIRCUIT DIAGRAM AND PARTS LISTING

There are many Model variants in the Microvitec SERIES 3 range. Obviously it would not be practical to supply all the circuit diagram variants. Therefore one circuit diagram is provided for the drive/deflection main PCB assembly and including the Tube Base assembly which is typical of SERIES 3 production. Two Parts Lists are provided; the first covers the 1431/MS4 model and the second covers earlier models and variants, for which circuit diagrams are included at the end of the list. These circuit diagrams are for earlier models with either a standard/medium resolution tube base or a high resolution tube base. Both lists should be employed in conjunction with the appropriate circuit diagram for confirmation of component values, types, rating, etc. on individual models.

Component location is a problem that you may encounter. To assist you in this matter we have included full PCB layouts. These PCB layouts should be used in conjunction with the circuit diagrams and accompanying waveform diagrams provided for full service information.

FAULT ISOLATION AND REPAIR PROCEDURE

Configured in a boxed flow chart format. Each fault is accompanied by a series of boxes which will ask you to check a particular part of the equipment. After you have carried out the check a question is asked (refer to Fig. 1).

INTERMITTENT -
LINE SYNC

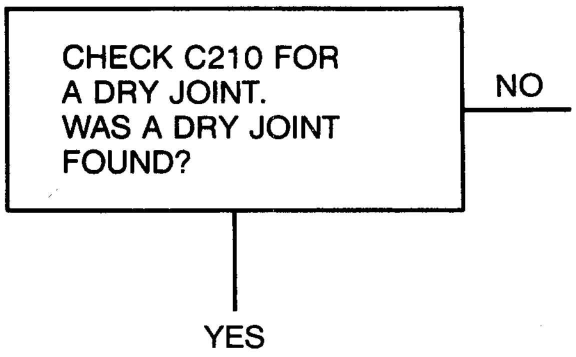

CHECK C210 FOR
A DRY JOINT.
WAS A DRY JOINT
FOUND?
NO
YES

FIG. 1

From the result of the question you can then answer YES or NO.

If the answer is NO (as in this case) you must move onto the next box and carry out the next check.

If the answer is YES, the next box will be (refer to Fig. 2).

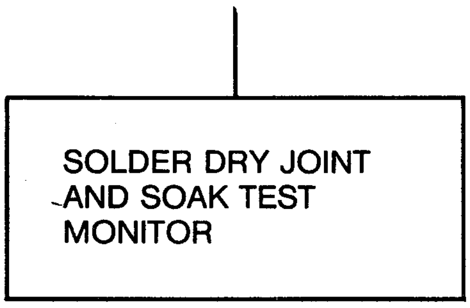

SOLDER DRY JOINT
AND SOAK TEST
MONITOR

FIG. 2

Further into the Fault Isolation Procedure you may be asked to check a component: for example (refer to Fig. 3).

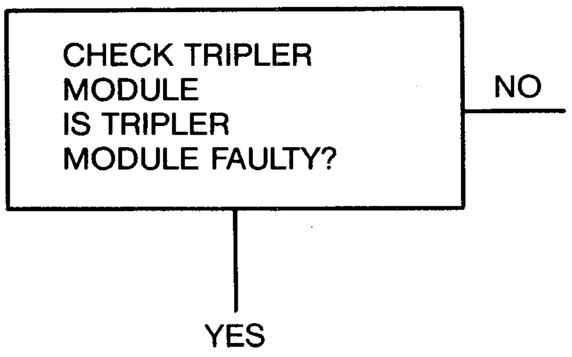

CHECK TRIPLER
MODULE
IS TRIPLER
MODULE FAULTY?
NO
YES

FIG. 3

In this case the best method of checking the Tripler Module would be substitution for a serviceable Tripler Module. This would establish very quickly the condition of the Tripler Module in relation to the fault.

When all the known fault causes have been effected, the chart will be terminated by a box reading: (refer to Fig. 4).

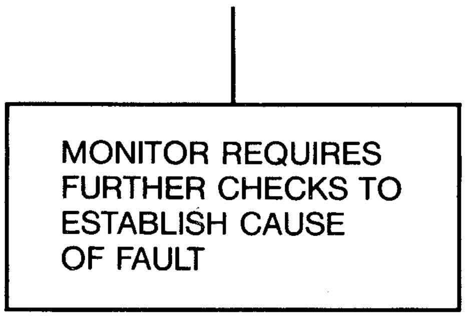

MONITOR REQUIRES
FURTHER CHECKS TO
ESTABLISH CAUSE
OF FAULT

FIG. 4

If you have reached this stage you should use the circuit diagram and items of test equipment and adopt a logical method of fault isolation and repair.

ILLUSTRATED PARTS LISTING (IPL)

This section contains all current cabinet designs in the Microvitec 'CUB' monitor range. It is intended to show the service technician how to gain access to the equipment for repair purposes. In addition component part numbers accompany each illustration; this will assist you when ordering a component part.

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

MODELS - 1431/1432

SYSTEM

1 ; 625 lines, 50 fields interlaced
or 312/313 lines, 50 fields non interlaced
2 ; 525 lines, 60 fields interlaced
or 262/263 lines, 60 fields non-interlaced
other non-standard systems may be suitable
consult MICROVITEC PLC.

MAINS SUPPLY

Nominal 180 - 265V, ~ 40 to 64Hz

TIMEBASE (LINE)

Pull-in range 15 to 16KHz

FRAME FREQUENCY

50Hz - Pull-in range 45 to 65Hz

POSITIONAL ERROR

± 3%

CONVERGENCE ERROR

0.6mm screen centre
1.6mm screen edge

EHT

24KV approximately

EHT REGULATION

± 1KV

LINE FREQUENCY

15.625KHz

DEGAUSSING

Automatic at switch ON

BANDWIDTH

18MHz

RESOLUTION

452(H)x585(V) elements

DOT PITCH

0.64mm

CRT

Rectangular 335.4mm (screen diagonal) 90 deg deflection.
Precision in-line gun vertical stripe screen, high voltage focus

SIGNAL INPUTS - MODEL 1431

TTL compatible; 1500 ohm R, G, B inputs link selectable, positive or negative video

SIGNAL INPUTS - MODEL 1432

Linear; 0 to 4V 1500 ohm R, G, B, inputs.
Positive video, composite or separate line and field synchronisation - each link selectable positive or negative

TECHNICAL SPECIFICATIONS

SIGNAL INPUT CONNECTOR

10 pin in-line 'SYSTEM 25' Pressac

OPERATING TEMP

0 to 55 deg C (max) open chassis
−10 deg C to +40 deg C (max)

POWER CONSUMPTION

65 Watts approximately

MODELS 1441 AND 1442 14" (HIGH RESOLUTION)

GENERAL NOTE

As Models 1431 and 1432, but with the following exceptions:

CONVERGENCE ERROR (MAX)

0.3mm screen centre
0.8mm screen edge

EHT

Approximately 24KV

BANDWIDTH

18MHz

RESOLUTION

895(H)x585(V) elements, rectangular 333mm (screen diagonal)
Automatic degaussing at switch on. High focus voltage in-line gun.
90 deg. diagonal deflection, 0.31mm dot pitch black matrix screen with pigmented phosphors.

DOT PITCH

0.31mm

POSITIONAL ERROR

± 2%

CONVERGENCE ERROR

0.8mm screen edge

MODEL 1451

GENERAL NOTE

As Models 1431 and 1432, but with the following exceptions:

RESOLUTION

652(H)x585(V) elements

DOT PITCH

0.43mm

CONVERGENCE ERROR

1.2mm screen edge

NOTE

A conversion kit is available which enables all the models listed above to be connected to a 110V supply. The kit is listed item by item in the Switched Mode Power Supply Section.

TECHNICAL SPECIFICATIONS

MODEL 2030

GENERAL NOTE

As Models 1431 and 1432, but with the following exceptions:

CONVERGENCE ERROR (MAX)

0.4mm screen centre
1.8mm screen edge

RESOLUTION

505(H)x585(V) elements, 80 characters on 6 dot, wide matrix

DOT PITCH

0.8mm

CRT

Rectangular 480mm (screen diagonal) 90 deg deflection precision in-line gun vertical stripe screen, high voltage focus

POWER CONSUMPTION

80 Watts approximately

MODEL 2040

GENERAL NOTE

As Models 1431 and 1432, but with the following exceptions:

RESOLUTION

940(H)x705(V) elements

DOT PITCH

0.47mm

POSITIONAL ERROR

± 4%

POWER CONSUMPTION

80 Watts approximately

CONVERGENCE ERROR

1.0mm screen edge

SAFETY STANDARDS

SAFETY STANDARDS

SAFETY AND ISOLATION

UNDER NO CIRCUMSTANCES SHOULD ANY FORM OF REPAIR OR MAINTENANCE BE ATTEMPTED BY ANY PERSON OTHER THAN A QUALIFIED ENGINEER.

SWITCHED MODE POWER SUPPLY

Although the outputs from the power supply are isolated from the incoming mains supply, the bridge rectifier and the control and regulation circuit **ARE NOT** isolated. Therefore, when servicing the power supply section of the chassis assembly, the SMPSU should be supplied by a MAINS ISOLATION TRANSFORMER OF AT LEAST 300VA RATING.

HANDLING PRECAUTIONS

HT ELECTRICAL CHARGES

The power supply section remains charged with respect to chassis for 30-60 seconds after switching off. Care should be taken when handling the chassis to avoid touching this area during this time.

EHT CHARGES - HORIZONTAL (LINE) OUTPUT STAGE/CRT

Before handling or attempting adjustment or replacement on the horizontal (line) output stage or on CRT areas - always discharge the final anode of the CRT - by using a suitable EHT probe only. Do this by connecting **first** to CRT dag earth coating/earth braid assembly, and then to CRT final anode/anode button 'poppy' connector.

PLEASE NOTE

Very considerable electrical charges can be stored in these areas - even for lengthy periods of time after 'switch off'.

In the interests of your personal safety observe the precautions listed.

SAFETY CRITICAL COMPONENTS

Components marked ⚠ on the parts list and circuit diagram are safety approved types and they should be replaced **only** with components supplied or approved by our Service Department. It is also recommended that the components not marked with the safety symbol should be replaced by parts of the type originally fitted, and this applies particularly to those resistors which are stood off the printed circuit boards.

HANDLING PRECAUTIONS - STATIC ELECTRICAL CHARGES

Depending on equipment type and model, the equipment may contain devices which may be damaged by static electrical charges during handling. Generally, these devices are indicated by a ⚠ symbol.

When replacing or handling these devices or PCBs containing such devices, care should be taken. Soldering irons should be earthed and personnel should use wrist straps earthed via a 1 Mohm resistor. If the latter is not practicable they should discharge themselves of any static electricity by touching an earthed point.

Static sensitive devices should be packed in suitable conductive containers.

NOTE

Electrostatic discharge does not necessarily 'kill' a component completely - more likely it will 'wound' it.

Many static wounded devices will pass normal test both on site and in Service Workshops. In this respect, PCBs containing such 'wounded' devices are a major cause of 'no fault found' problems.

It pays, therefore, to cultivate static safe ways when dealing with such static sensitive equipment.

SAFETY STANDARDS

OPERATING SAFETY

We recommend – after effecting any Service and/or replacement of any part of the monitor, or after any repair work – that the SAFETY CHECKS listed following are carried out.

NOTE

Ensure on re-assembly that ALL earth connections are replaced SECURELY; in particular safety earths and the 'P' band and dag earth 'CRT' earth connections.

IMPORTANT!

Failure to observe the points noted could affect your own safety, the product's safety and ultimately, that of the user.

SAFETY CHECKS

EARTH CONTINUITY CHECK

a) Using a suitable multimeter:

Check between 'Dag' earth on the CRT and mains plug earth pin, (safety earth connection). The reading should be less than 470Kohm (with tube discharged).

b) Check mains earth continuity between mains plug earth pin and:

1. CRT 'P' Band.
2. PCB 'Earth' pin on main chassis.

c) The final assembly/housing should be checked for continuity between the mains plug earth pin ⏚ , and ALL exposed metalwork.

NOTE

Tests b) and c) should have a resistance of less than 0.5 ohm.

HIGH VOLTAGE ISOLATION/INSULATION CHECKS

a) On the mains supply 3-pin plug – check between 'live' and 'neutral' to 'earth' ⏚ for leakage and breakdown.

This test should be made with 1.5KV to 1.6KV AC or DC equivalent.

ON TEST

1. No breakdown should occur.
2. Earth leakage should be less than 6mA at 1.5KV.

b) Insulation resistance should be greater than 2 Megohms at 500V DC.

CAUTION

A MONITOR FAILING ANY OF THE ABOVE CHECKS MUST BE RESTORED TO SAFE WORKING CONDITION BEFORE BEING RETURNED TO THE USER.

ELECTRICAL SUPPLY

WARNING

THIS APPARATUS MUST BE EARTHED.

IMPORTANT

The wires in the mains lead are coloured in accordance with the following code:

GREEN AND YELLOW : EARTH
BLUE : NEUTRAL
BROWN : LIVE

As the colours of the wires in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

SAFETY STANDARDS

Earth

The wire coloured GREEN and YELLOW must be connected to the terminal marked 'E' or by the safety earth symbol ⏚ or coloured GREEN, or GREEN and YELLOW.

Neutral

The wire coloured BLUE must be connected to the terminal marked 'N', or coloured BLACK.

Live

The wire coloured BROWN must be connected to the terminal marked 'L', or coloured RED.

X-RAY RADIATION

X-rays constitute a health hazard on prolonged exposure at close range unless adequate shielding is provided.

Precautions must be exercised during servicing of display equipment to ensure that the anode voltage and other tube voltages are adjusted to the recommended values.

Replace with a tube of the same type number or recommended replacement to assure continued safety.

IMPLOSION PROTECTION

This tube employs integral implosion protection and must be replaced with a tube of the same type or a recommended replacement to assure continued safety.

SHOCK HAZARD

The high voltage at which the tube is operated may be very dangerous. Extreme care should be taken in the servicing or adjustment of any high voltage circuit. Caution must be exercised during the replacement or servicing of the tube since a residual electrical charge may be contained on the high voltage capacitor formed by the external and internal conductive coating of the tube funnel. To remove any undesirable residual high voltage charges from the tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the tube, to the external conductive coating before handling the tube.

TUBE HANDLING

Wear heavy protective clothing, including gloves and safety goggles with side shields. Handle the tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

INPUT
CONNECTIONS

INPUT CONNECTIONS AND CUSTOMER CONTROLS

T.T.L. COMPATIBLE/LINEAR INPUT SELECTION

T.T.L. compatible or linear (0 to 4V, 1500 ohm) input level options can be selected by moving 3 links:

TL103 R,G,B located on main PCB:
position 1 corresponds with linear levels
position 2 with T.T.L. levels

NOTE

Contrast control VR111, inoperative when position 1 is selected.

SYNCHRONISATION - INPUT OPTIONS

Sync inputs must be T.T.L. compatible, the timing of sync pulses should approximately correspond with those used for broadcast purposes (refer to Fig. 1 for available options.)

INVERSE VIDEO

To facilitate inversion of T.T.L. compatible video input signals by either moving link TL101 on main PCB to position 1, or removing TL101 and feeding a positive T.T.L. level in to pin 9 of PL101.

NOTE

Monitors are normally despatched wired in composite negative (going) syncs mode, with TL102 not fitted, and TL106 selected to position 1.

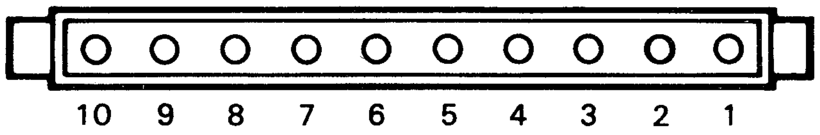


FIG. 1 SIGNAL INPUT PIN CONNECTIONS

KEY
1 = +12V
2 = No connection
3 = Sync 3; +field sync
4 = Red video
5 = Sync 2; -field sync
6 = Green video
7 = Sync 1; composite sync or line sync
8 = Blue video
9 = Normal/inverse T.T.L. video
10 = Ground

SYNCHRONISATION OPTIONS

SYNC OPTIONS	INPUTS (PL101)	LINK POSITION
MIXED		
−ve going	pin 7	TL102 not fitted
		TL106 in position 1
	pin 7	TL102 fitted
+ve going		TL106 in position 1
SEPARATE		
−ve line	pin 7	TL102 not fitted
−ve field	pin 5	TL106 in position 1
+ve line	pin 7	TL102 fitted
+ve field	pin 3	TL106 in position 2
−ve line	pin 7	TL102 not fitted
+ve field	pin 3	TL106 in position 1

CUSTOMER CONTROLS

NOTE

On 'D' series monitors the controls listed below are located on the front of the monitor, concealed behind a downward hinging door.

ON/OFF Switch

Mounted rear of the monitor, allows mains to be switched on and off without switching the mains supply off.

Contrast/Brilliance Adjustment (VR111)

Mounted rear of main PCB, only active in T.T.L. mode, and allows video gain to be varied from maximum to minimum, at black level.

Brightness Adjustment (VR134 when fitted)

Mounted rear of main PCB, next to VR111. Active in all modes of operation allowing brightness of display to be varied above or below cut off.

Volume/Audio Adjustment (when fitted)

Mounted rear of the monitor, allows user to adjust volume/audio level of the monitor. Clockwise to increase, anti-clockwise to decrease.

Colour Saturation Control (when fitted)

Mounted rear of the monitor, allows user to adjust the colour level of the monitor. Clockwise to increase, anti-clockwise to decrease.

FACTORY PRESET
ADJUSTMENTS

PRESET CONTROLS/ADJUSTMENTS

GENERAL

Preset controls are initially set up at the factory and normally do not require adjustment unless a change is required in the input configuration - for example, typically to install a different graphics adaptor card in the associated host system. Details of the preset controls with their use and adjustment is described following:

PRESET ADJUSTMENTS

TO PROTECT AGAINST ELECTRICAL SHOCK HAZARD AND TO PROTECT THE MONITOR AGAINST SHORT CIRCUIT AND DAMAGE - USE ONLY AN INSULATED NON-METALLIC TRIMMING TOOL TO MAKE ADJUSTMENTS TO THE PRESET CONTROLS.

Care should be taken when adjusting presets. Adjust only one at a time and note carefully the effects of the adjustment before proceeding on the other adjustments. In some cases, it may be advisable to take note of the original setting position of the preset BEFORE adjustment in case the need arises to return to the original setting.

INTERCONNECTION COMPATIBILITY

On installation and prior to preset adjustments, ensure that video and sync connections from the host system are compatible with:

a) The monitor.

b) The interconnecting lead assembly in use.

Having determined these points are correct proceed with the adjustments required according to the details given in the accompanying table and description following.

PRESET CONTROL SETTING

1. To set the preset controls, use a signal generating a display occupying as large a screen area as possible. For example a full page of upper case letter 'H' would be suitable, or alternatively a suitable test card as appropriate.

2. Preset controls in the table following marked with an asterisk * may be adjusted if required.

   However, normally this should not be necessary, as these presets are set accurately at the factory during manufacture.

   ### NOTE

   A circle is employed in the screen displays illustrated following, only to demonstrate more clearly the geometric effects of wrong settings.

PRESET LOCATIONS

The physical locations of most of the preset controls referred to in the descriptions following are shown in the illustration contained in the Section preceding.

Notable exceptions are preset controls contained on the TUBE BASE PCB assembly.

The positions of these presets are indicated on the individual PCB's by appropriate ident markings.

PRESET CONTROLS/ADJUSTMENTS

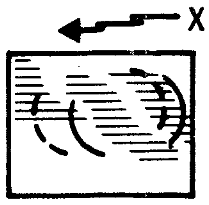
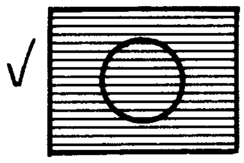
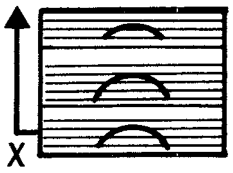
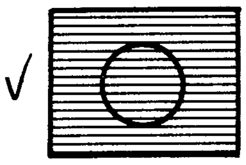
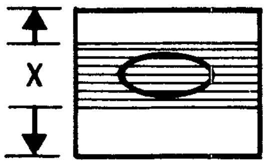
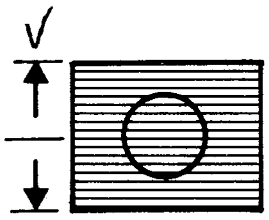
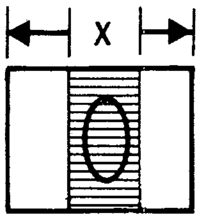
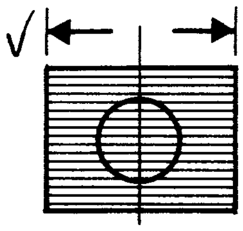
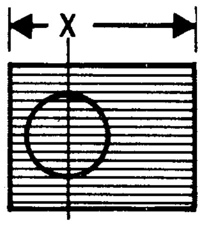
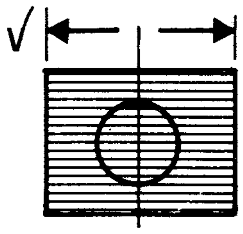
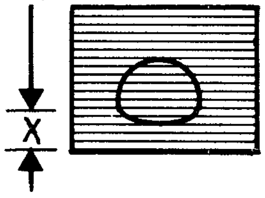
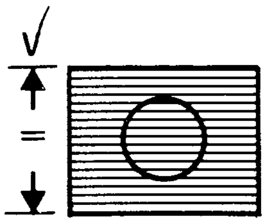
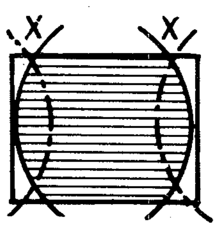
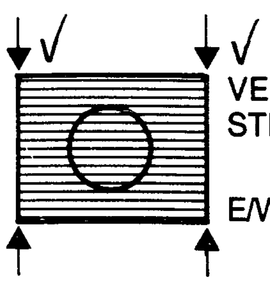
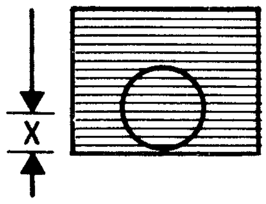
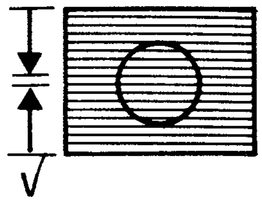
PRESET	WRONG X	RIGHT √
LINE FREQUENCY	PICTURE BREAKS UP ADJUST L.FREQ. 	 PICTURE LOCKED
FIELD FREQUENCY	PICTURE ROLLS ADJUST F.FREQ. 	 PICTURE LOCKED
HEIGHT	ADJUST HEIGHT 	 HEIGHT SET
WIDTH	ADJUST WIDTH 	 WIDTH SET
LINE PHASE*	PICTURE NOT CENTRAL ADJUST L. PHASE 	 PICTURE CENTRAL PHASE SET
FIELD LINEARITY* (VERTICAL LINEARITY)	BOTTOM (OR TOP) OF PICTURE COMPRESSED ADJUST F.LIN 	 VERTICAL SCAN LINEAR LIN.SET
EAST/WEST* CORRECTION	PICTURE 'BARREL SHAPED' OR 'PIN-CUSHION' SHAPED —  ADJUST E/W CORRECTION	 VERTICAL EDGES STRAIGHT E/W SET
FIELD SHIFT	PICTURE NOT CENTRAL ADJUST FIELD SHIFT 	 PICTURE CENTRAL FIELD SHIFT SET

TABLE OF PRESET ADJUSTMENTS

PRESET CONTROLS/ADJUSTMENTS

FACTORY PRESET ADJUSTMENTS

NOTE

Certain preset adjustments can be from above or below the main panel. Adjustments are best made on a static display, preferably a Microvitec suitable test card or test pattern.

SET HT - VR1

Adjusted accurately at the factory to give 142V with a dark picture on screen, and should not be readjusted.

WARNING

THIS IS A CRITICAL SAFETY ADJUSTMENT. FAILURE TO COMPLY WITH THE ABOVE WILL INVALIDATE THE WARRANTY.

LINE FREQUENCY VR218

1. Set the free running oscillator frequency to almost frequency of incoming line syncs.
2. Adjust VR218, feed monitor with R.G.B. video and interrupt the mixed sync information to the line oscillator by removing sync information on PL101, (sync 1, 2 or 3 etc).
3. Adjust VR218, until the picture almost stabilizes then re-connect via PL101 as required. Resulting in a stable picture lock.

FIELD FREQUENCY VR307

Control of the free running field oscillator frequency by adjusting VR307, gives a stable picture lock. For effective lock VR307 should be set to 56Hz.

LINE PHASE VR220

VR220, controls positioning of video information relative to raster in line scan direction.

Ensure the following operations have been effected:

1. The line frequency has been set (VR218).
2. The picture width has been set (L202).
3. The monitor is positioned in its place of use.

NOTE

1. VR220 when adjusted will shift the picture, right or left.
2. VR220 only adjusts the picture relative to the raster position. Prior to adjustment, ensure that the sides of the picture are not folding over.

WIDTH L202

CAUTION

CARE SHOULD BE TAKEN WHEN ADJUSTING THIS COMPONENT DUE TO ITS PROXIMITY TO EHT SECTION, IN PARTICULAR, THE TRIPLER AND LINE OUTPUT TRANSFORMER.

Using a non-metallic trimming tool adjust L202, to effect picture width adjustment.

Normally factory set for maximum width.

NOTE

L202 core may not always be fitted.

HEIGHT VR306

VR306, when adjusted will provide for raster under scan and overscan.

PRESET CONTROLS/ADJUSTMENTS

FIELD LINEARITY VR312

Adjust VR312, to give a linear picture in vertical direction.

NOTE

Best results are obtained by using a cross hatch type grid or MICROVITEC test generator.

FIELD SHIFT VR312

VR321, controls positioning of raster in field scan direction.

EAST-WEST CORRECTION VR328

NOTE

Some models will not require this adjustment, because east-west correction is integral on certain types of CRT.

Adjustment of VR328 will achieve straight verticals on left and right hand sides of pictures.

FOCUS

Located on end of tripler module, set brightness control to normal viewing level, then make focus adjustment.

ADJUST COLOUR BACKGROUND CONTROLS (BLACK LEVEL)

NOTE

These controls are factory preset. If adjustment is necessary, an AVO 8 multimeter and/or oscilloscope will be required. However, best results are obtained by using an oscilloscope.

Prepare to adjust colour background controls

1. Set customer contrast (VR111), brightness (VR314) and A1 (VR932) full anti-clockwise.
2. Disconnect R.G.B. sync inputs

Adust red, green and blue

1. Adjust VR906 for red cathode (black level) volts
2. Adjust VR914 for green cathode (black level) volts
3. Adjust VR921 for blue cathode (black level) volts
4. The above voltages are:
   a) 150V-14″ monitor (TTL or Linear)
   b) 155V-20″ monitor (TTL or Linear)
   c) 140V-12″/14″ high res monitor (TTL or Linear)

Adjust A1 voltage

1. Adjust VR932 until a raster is just visible.
2. Raster colour may be neutral. However, it is very likely shaded towards red, green, blue or a combination of any two colours.
3. Establish raster colour shading as follows:
   a) Red and Green - Yellow
   b) Red and Blue - Magenta
   c) Blue and Green - Cyan

4. Reduce black level of remaining one or two guns using VR906, VR914, VR921 or combination until a neutral raster is achieved.
5. Re-adjust VR932 to just extinguish raster.
6. Input - R,G,B and sync signals, then adjust VR111 clockwise.
7. If correct while balance has not been achieved, repeat operations 1 through to 6.

ADJUST COLOUR GAIN CONTROLS

CAUTION

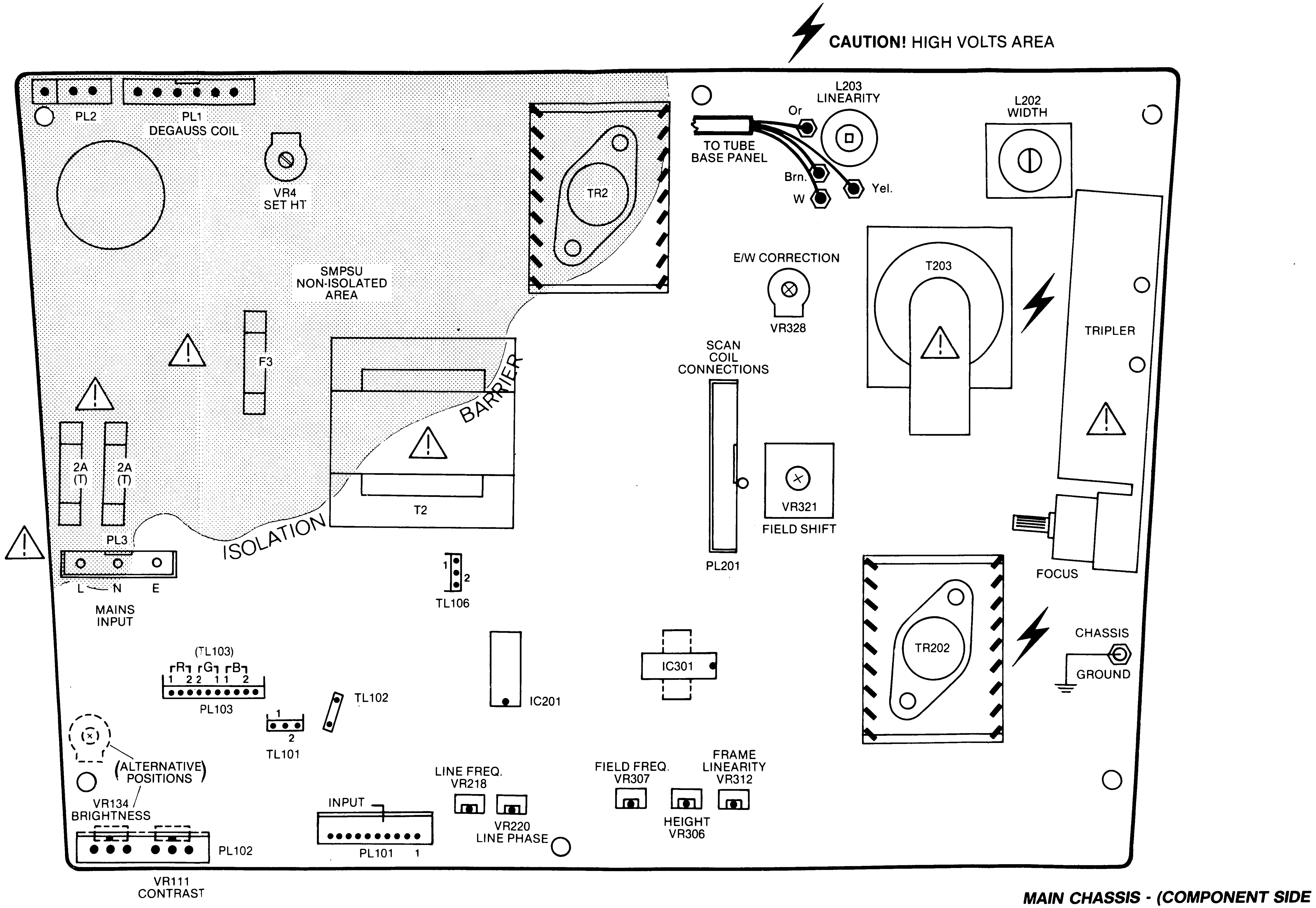
MAKE THE FOLLOWING ADJUSTMENTS USING A DC COUPLED OSCILLOSCOPE ONLY.

Prepare to adjust colour gain controls

1. Disable beam current limit circuit by removing TL901 in series with CRT heaters on tube base panel.
2. Provide a test pattern with peak white and black level information on red, green and blue.
3. Ensure VR111 is fully clockwise to provide maximum drive voltages to video output stages.
4. Above voltages are:
   a) 70V p-p on 14" monitor - TTL mode
   b) 70V p-p on 20" monitor - TTL mode
   c) 60V p-p on 14"/20" monitor - medium and high resolution

Adjust red, green and blue gain controls

1. Adjust VR903, for red peak to peak drive volts at R926.
2. Adjust VR910, for green peak to peak volts at R925.
3. Adjust VR916, for blue peak to peak volts at R924.


CAUTION! HIGH VOLTS AREA
PL2
PL1
DEGAUSS COIL
VR4
SET HT
TR2
TO TUBE
BASE PANEL
Or
L203
LINEARITY
Brn.
W
Yel.
L202
WIDTH
SMPSU
NON-ISOLATED
AREA
E/W CORRECTION
VR328
T203
TRIPLER
F3
BARRIER
SCAN
COIL
CONNECTIONS
2A
(T)
2A
(T)
T2
VR321
FIELD SHIFT
PL3
ISOLATION
PL201
FOCUS
L
N
E
MAINS
INPUT
1
2
TL106
CHASSIS
GROUND
TR202
(TL103)
R
G
B
1
2 2
1 1
2
PL103
TL102
IC201
IC301
1
2
TL101
(ALTERNATIVE POSITIONS)
VR134
BRIGHTNESS
LINE FREQ.
VR218
FIELD FREQ.
VR307
FRAME
LINEARITY
VR312
INPUT
VR220
LINE PHASE
HEIGHT
VR306
PL102
PL101
1
VR111
CONTRAST

MAIN CHASSIS - (COMPONENT SIDE SHOWING PRESETS/CONNECTORS AND WIRE LINK LOCATIONS ETC)

REMOVAL/INSTALLATION
DETAILS

REMOVAL/INSTALLATION DETAILS

IMPORTANT NOTES

Refer to the notes in the Safety Standards Section contained in this Manual, before carrying out any of the operations following. The safety guidelines given in these notes apply to the repair, service, and/or replacement of parts or components - or if attempting adjustments to the monitor in any way.

WARNING

ENSURE THE MONITOR IS DISCONNECTED FROM THE MAINS ELECTRICAL SUPPLY BEFORE EFFECTING ANY OF THE OPERATIONS DETAILED FOLLOWING:

DANGER!

THE PICTURE TUBE STAYS CHARGED TO THE FULL EHT VOLTAGE.

Discharge the tube **BEFORE** attempting to remove the EHT cap (Poppy) connector. (See Safety Standards Section).

Observe the warning to delay handling the chassis for 30-60 seconds after switch off.

MAIN PCB REMOVAL/INSTALLATION (FIG 1)

1. OBSERVE NOTES UNDER 'SAFETY STANDARDS - EHT CHARGE'. Disconnect EHT lead (1) from CRT. (Refer to Fig. 1a).
   To ensure no charge remains on tripler connect the EHT lead to chassis metalwork.
2. Discharge CRT final anode by connecting it first to CRT dag coating, using a suitable EHT probe only, then to CRT final anode EHT button connector.
3. Refer to Figs 1b and 1c - Disconnect PL201 (2), PL1 (3) and mains plug PL3.
4. Refer to Fig 1d - Remove tube base panel and CRT earthing braid tag from earth braid pin on Tube Base panel, marked CRT.
5. Refer to Fig 1e - Remove 'P' band earthing tag (5) from main PCB, located next to tripler module.
6. Disconnect PL101 (7), PL102 (8), (Refer to Fig 1e) then disconnect tube base from CRT. (Refer to Fig 1d).
7. Release in turn, each of the nylon self locking PCB support clips (6), as shown in Fig 1f, lifting PCB slightly in each case.
8. The main PCB may now be removed by lifting upwards, and withdrawing from the rear together with the tube base panel, as shown in Fig 1g.
9. For installation effect the above operations in reverse order.

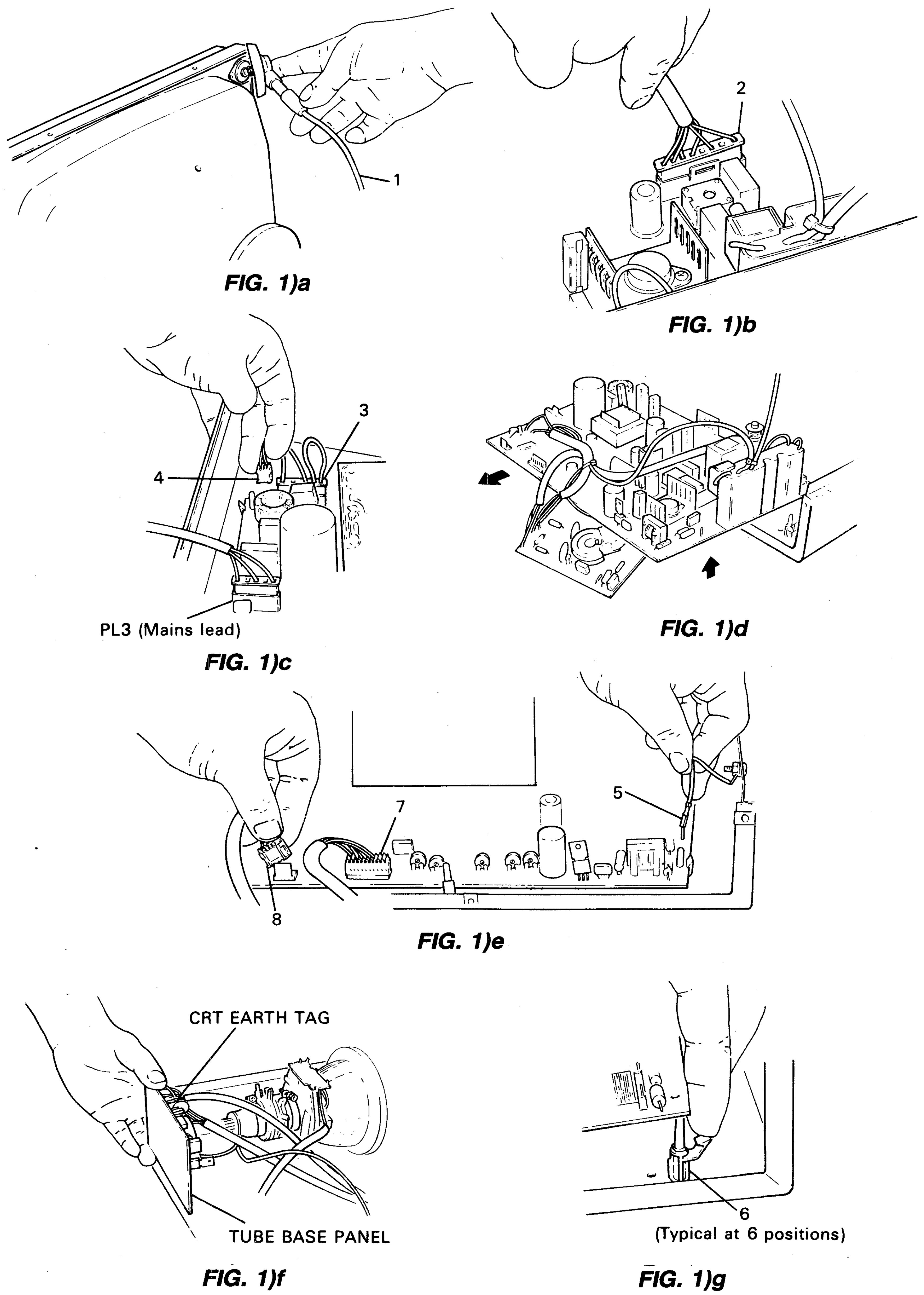

1
2
3
4
PL3 (Mains lead)
7
5
8
CRT EARTH TAG
TUBE BASE PANEL
6
(Typical at 6 positions)

FIG. 1)a

FIG. 1)b

FIG. 1)c

FIG. 1)d

FIG. 1)e

FIG. 1)f

FIG. 1)g

FIG. 1 MAIN PCB REMOVAL/INSTALLATION DETAILS

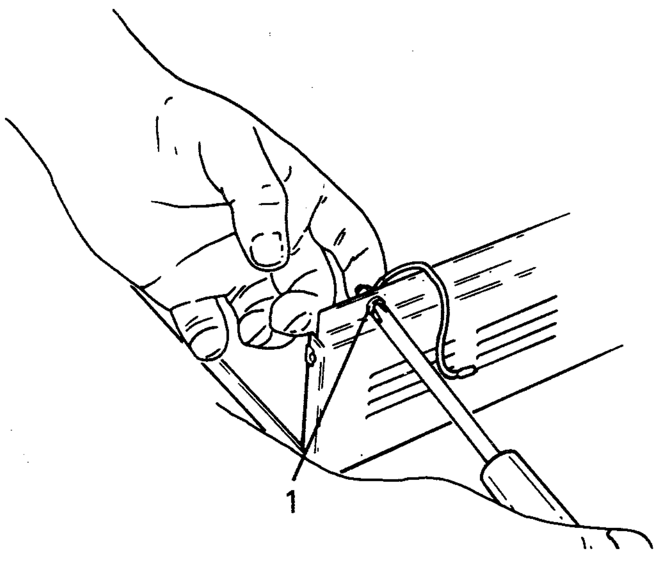


FIG. 2)a

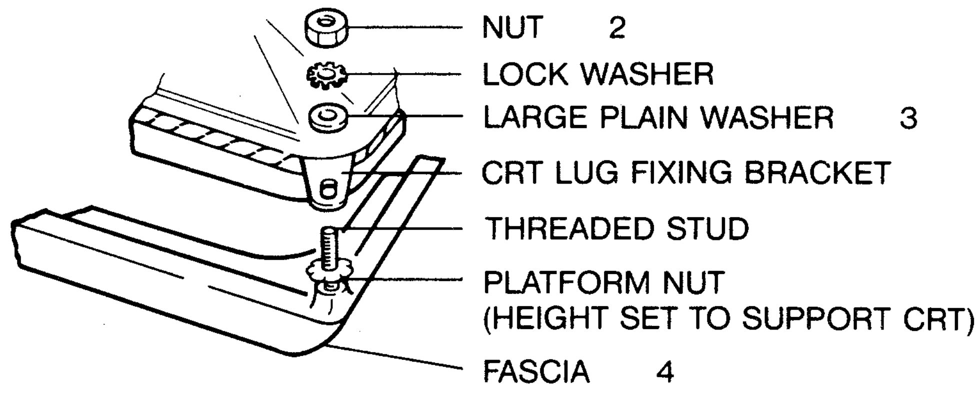

NUT 2
LOCK WASHER
LARGE PLAIN WASHER 3
CRT LUG FIXING BRACKET
THREADED STUD
PLATFORM NUT
(HEIGHT SET TO SUPPORT CRT)
FASCIA 4

FIG. 2)b

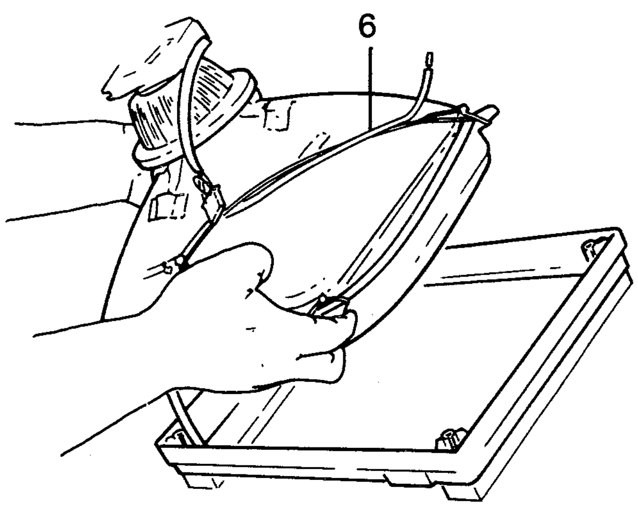


FIG. 2)c

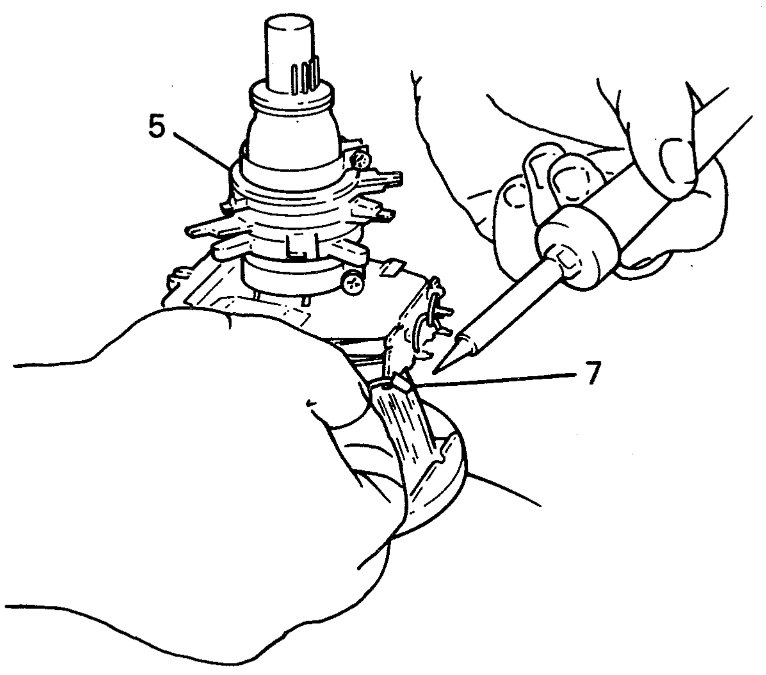


FIG. 2)d

FIG. 2 CRT REMOVAL/INSTALLATION

CRT REMOVAL/INSTALLATION (FIG. 2)

OBSERVE NOTES UNDER 'SAFETY STANDARDS - EHT CHARGES'.

1. Effect operations 1 through 8 for MAIN PCB REMOVAL/INSTALLATION, then position monitor so that the CRT is face down on two padded support blocks.

2. Remove two earthing screws (1). (See Fig. 2)a), then refer to the illustrated mechanical parts section and remove the base of the monitor.

3. Unplug as required - Interconnecting Lead Assemblies/Wiring Harness Connections, Tube Base PCB Assembly from CRT Tube Base, and EHT Connector, etc. Unplug CRT earth braid lead from dag earth braid pin on Tube Base Panel, marked CRT.

4. Detach as required the various earthing lead flexible connections.

IMPORTANT NOTE

Ensure on re-assembly that ALL earth connections are replaced SECURELY; in particular Safety Earths and the 'P' band and dag earth CRT earth connections.

5. Remove the four nuts (2) and four lockwashers and four large plain washers (3) securing CRT to cabinet fascia (4). (See Fig. 2)b).

6. Carefully withdraw CRT vertically. Be careful not to disturb the height settings of the platform nuts supporting the CRT (Fig. 2)b).

7. Transfer degauss coil (5) and earthing braid (6) in Fig. 2)a and scan coil lead assembly (7) (Fig. 2)d to new CRT. When fitting the new CRT ensure the height of platform nuts are set correctly, so that the CRT is supported by the CRT lug fixing brackets. (See Fig. 2)b).

IMPORTANT

Do not disturb the tube neck components. These have been set for optimum performance during manufacture and are an integral part of the tube system.

8. Install main PCB assembly by effecting operations 1 through 8, for MAIN PCB REMOVAL/INSTALLATION, in reverse order.

9. CRT installation safety checks:

   a) Check for correct fitting of CRT earthing braid item 6 in Fig. 2)a.

   b) Ensure black lead from CRT earth braid to tube base is connected.

   c) Check 'P' band earth has been re-connected.

LINE OUTPUT TRANSISTOR (TR202) AND SMPSU OUTPUT TRANSISTOR (TR2) - REMOVAL/INSTALLATION (FIG 3)

REMOVE TRANSISTOR

1. Remove two M3 screws (1) securing transistor and heatsink to main PCB.

2. Unsolder base and emitter connections on PCB, then withdraw transistor/heatsink (4)

3. Separate transistor from heatsink, retaining insulating bushes (3) and mica washer (2) for refitment.

INSTALL TRANSISTOR

1. Coat underside of transistor with thermally conductive heatsink compound.

2. Effect previous operations, 1. through 3., in reverse order.

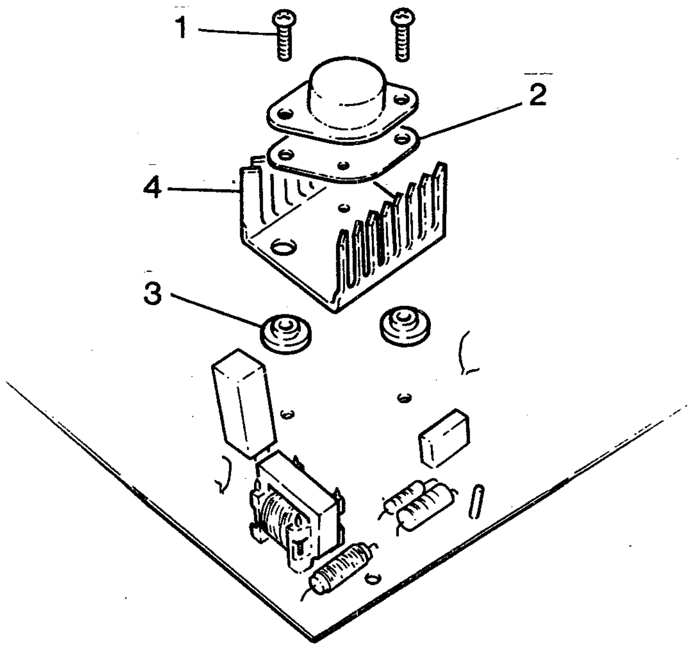


FIG. 3 LINE OUTPUT TRANSISTOR (TR202) AND SMPSU OUTPUT TRANSISTOR - REMOVAL/INSTALLATION

TRIPLER - REMOVAL/INSTALLATION (FIG. 4)

REMOVAL

1. Remove EHT lead from CRT and discharge CRT final anode to the earth braid.
2. Unsolder the following: Lead from line output transformer overwind (1) focus lead (2) to tube base panel at the tripler end.
3. Unsolder from main PCB: Earth return (3) from focus control, clamp diode earth return (4)
4. Loosen, but do not remove tripler securing screws (5), then withdraw tripler module (6) from main PCB.

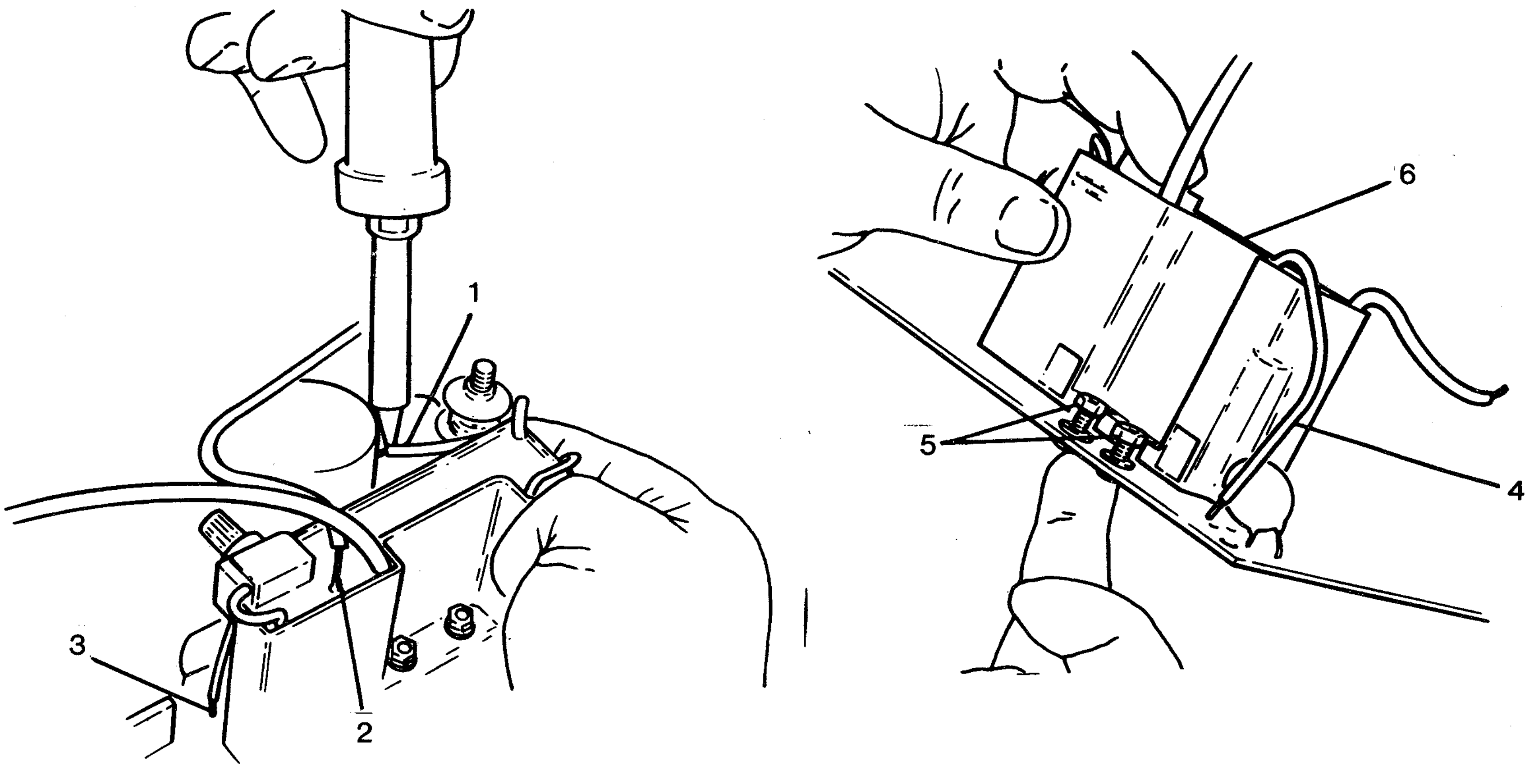
INSTALLATION

1. Position tripler module (6) on main PCB assembly and secure with screws (5).
2. Solder on main PCB: Earth return (3) from focus control, clamp diode earth return (4).
3. Solder : Lead from line output transformer overwind (1) focus lead (2) to tube base panel at the tripler end replace insulation sleeve on connection (2).

NOTE

Ensure all soldered connections are smooth and connecting wires kept as short as possible, to guarantee adequate voltage clearances.

4 Connect EHT lead to CRT final anode.



NOTE: Replace the insulation sleeve on connection (2)

FIG. 4 TRIPLER REMOVAL/INSTALLATION

SWITCH MODE
POWER SUPPLY

SWITCHED MODE POWER SUPPLY

GENERAL

The power supply is a variable frequency, self oscillating, switching flyback converter type providing mains isolation and three voltages, 18 volts, 142 volts and 200 volts. The 18V supply is used to provide a 12V stabilised supply, via IC1.

The Series 3 monitor is fitted with one of three switch mode power supply unit variants, referred to as A, B and C, which are used with either the earlier, mid or latest range of models. The power supply units function in the same way but differ only in changes to component types or values. The main difference between power supply variants A and B is that component TR2 on variant B is a different type to that on variant A. Component changes on power supply variant C are given on the circuit diagram for the power supply unit and are detailed in the parts list.

CIRCUIT DESCRIPTION

Refer to the main circuit diagram for the following circuit description, which is applicable to all three power supply unit variants. **The circuit diagram is typical for a Series 3 monitor, but reference should be made to the Parts List for details of components for individual models.**

CONTROL CIRCUIT

As TR2 turns on, a step voltage whose amplitude depends upon the instantaneous value of the rectified mains is applied across the primary of T2. The current in the winding and TR2's collector increases linearly from zero during which time energy is stored as flux in the transformer. During this period the output diodes D22, 23, 24 are reverse biased and any energy supplied to the load is via C27, 28, 31 and 26 from the previous cycle of operation.

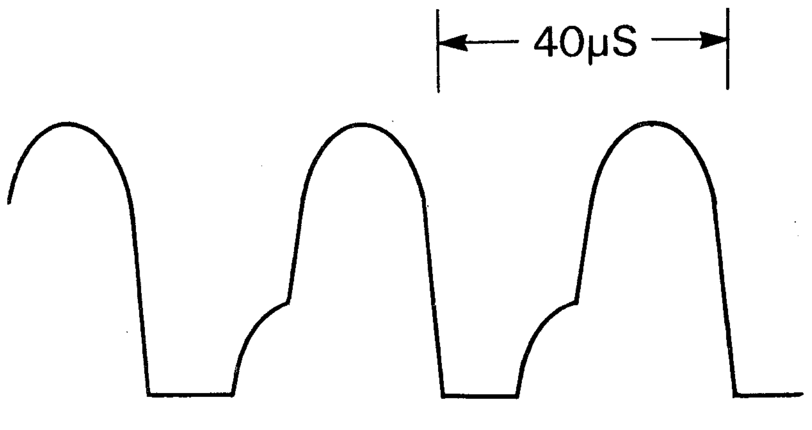
TR1 forms the error amplifier or control function, and is supplied with power from a reference winding on the transformer (nominally +30V). During the on time of TR2, the emitter TR1 is held at a constant potential W.R.T. the reference rail via D18. The base of TR1 is fed directly from the reference rail, via R3, VR4 and R5. Any voltage change on the reference rail, arising from a change of voltage at the mains output, via D23, will vary the TR1 base-emitter voltage and current. As a result, the collector current will vary causing the constant current source, used to charge C16 via R10 to vary in sympathy.

C16 charges up at a rate depending upon the amount of current available via R10, and the voltage across C16 increases exponentially until it reaches the gate-trigger voltage of the 'turn off' device TY1. Then TY1 conducts and 'crow-bars' the base drive to TR2. TR2 ceases conduction and its collector voltage becomes positive very rapidly. The dV/dT at TR2's collector is limited to a safe value by C17, R12 and D17. As this occurs, D22, 23, 24 and 21 become forward biased and stored energy within the transformer is transferred into the output capacitors and their respective loads.

During the 'off' period the base drive winding goes negative thus ensuring TR2 remains off until the next conduction period. D8, D10, D11 limit the negative off drive and so protect TY1.

Eventually, depending upon the load, the energy in the transformer is exhausted and the voltages on D6, 21, 22, 23 and 24 anodes collapse as does the TR2 collector-emitter voltage, during which time the base drive winding tends more positive. TY1 is forced off prior to this stage by negative volts on its anode, allowing TR2 to turn on. Full base drive is then sustained via R16.

HT stabilisation is achieved by controlling the duty cycle of the switching transistor. Increasing load increases the duty cycle and the peak collector current, while increasing supply mains increases the overall operating frequency. HT adjustment is performed via VR4.



TR2 BASE START-UP Fuse F3 out

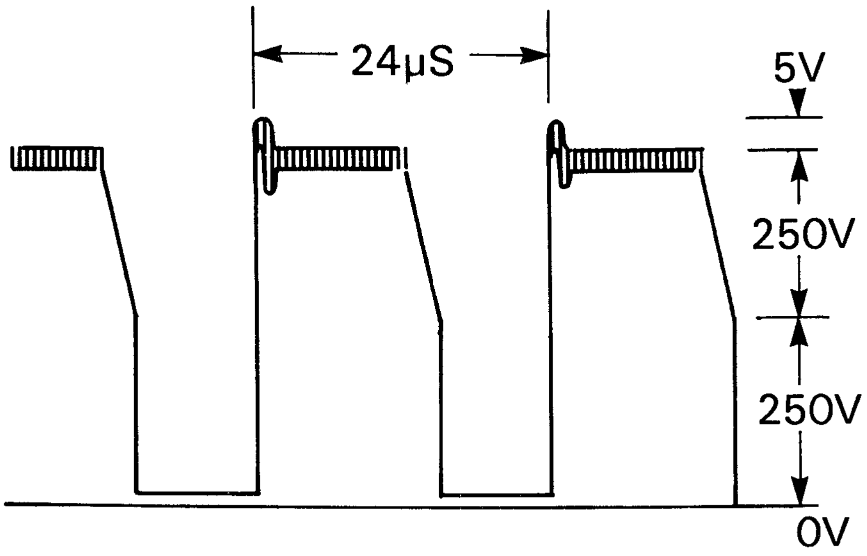
Extra damping in the form of C14, R6 and D7 is provided in order to limit the maximum Vce of TR2 to a safe value, even under fault conditions. D15, 16 provide negative off drive and base current tracking while L2 optimises the storage time of TR2 for minimum switching losses.

The maximum available power is determined by measuring the peak collector current of TR2 and is sensed by R15. If the voltage across R15 at any time exceeds the voltage across TY1 gate-cathode plus three diode drops D12, 13, 14, then TY1 is immediately brought into conduction thus turning TR2 off. This sequence of events happens during the start up sequence at low mains and under fault conditions.

START UP PROCEDURE

Start up power for the SMPSU is derived from a half wave rectified positive going differentiated pulse from the mains supply. The current required at start up is small compared with the base drive current under normal operating conditions because of the self oscillating nature of the design. Once turn on of TR2 has been achieved in this manner (once every 20 ms) the oscillation becomes self-sustaining. R8 continues to supply current even under normal operation but is swamped by the forward base drive via R16.

During the start up period the peak collector current is limited by R15. C21, R18 and 20 provide active feed forward so as to provide ripple rejection over the mains range 190-256V.



TR2 COLLECTOR Fuse F3 in - connector PL201 out (no load)

OVER VOLTAGE PROTECTION

Over voltage protection is controlled by a second feedback loop attached to TY1. This consists of a zener diode reference which senses the reference rail voltage, and hence, proportionally, the HT voltage. If this reference exceeds the zener voltage, D20 conducts, fires TY1 and terminates the drive to TR2, during which time sufficient volts are developed across TY2 gate-cathode to cause it to enter conduction and latch on. Drive to TR2 is now terminated until all the energy from C23 has been removed (10ms). The power supply is held off during this period and remains so until the presence of the next mains start up pulse, after which conduction of TR2 will again occur.

SHORT CIRCUIT PROTECTION

Short circuit or over current on any output rail represents an increase in stored energy required from the transformer T2, and therefore an increase in collector current through TR2, again this is detected by R15 and above a preset load, TY1 is fired and TR2 turned off. The supply now operates in 'Burst Mode'. This means that the power supply is initiated as under normal start up conditions once every mains cycle, but only operates for a few switching cycles during which time the over current protection again comes into operation thus terminating the drive to TR2.

MAINS INPUT CIRCUIT

This consists of a diode bridge preceded by a surge limiting thermistor and mains filter network. Degaussing is automatic at switch on and employs a dual PTC thermistor. The mains filter networks provide suitable suppression of the symmetric and assymetric radiation developed within the SMPSU concept.

NOTES

1. For the 110V power supply unit there will be certain component differences between the 240V power supply unit. These are detailed as follows:

Component	240V P.S.U.	110V P.S.U.
L1	LO001ZA1	LO001KA6
R5	RF104OJ0 10K	RM913GK0 9K1
R8	RF333JJ0 3K3	RF224GJ0 22K
R15	RQ150LJ0(1) 1R5	RO150LJ0(2) 1R5
R16	RW472ZJ5 470R	RW103XJ5 1K9W
R18	Not fitted	RF394GJ0 39K
R20	Not fitted	RF394GJ0 39K
R29	RF185DJ0 180K	RF684DJ0 68K
C10	CM564RK6 56nF	CM105NL6 0.1μF
C11	CA108RM6 100μF	CA228QM7 220μF
C21	Not fitted	CM105RK6 0.1μF
TH1	RT005QN0	RT002QL0
T2	TI0004I06	TL002SU0 (3960)
F1	KA2001BA0 2A	KA3151BA0 3.15A
F2	KA2001BA0 2A	KA3151BA0 3.15A
F3	KA1001BQ0 1A	KA2001BQ0 2A

2. Later version power supplies have the following changes:

240V	110V
R1 — Removed	R1 — Removed
D5 — Wire link	D5 — Wire link
C10 — 22K Res. ½W	C10 — Wire link
R8 — 22K Res. ½W	R8 — 22K Res. ½W

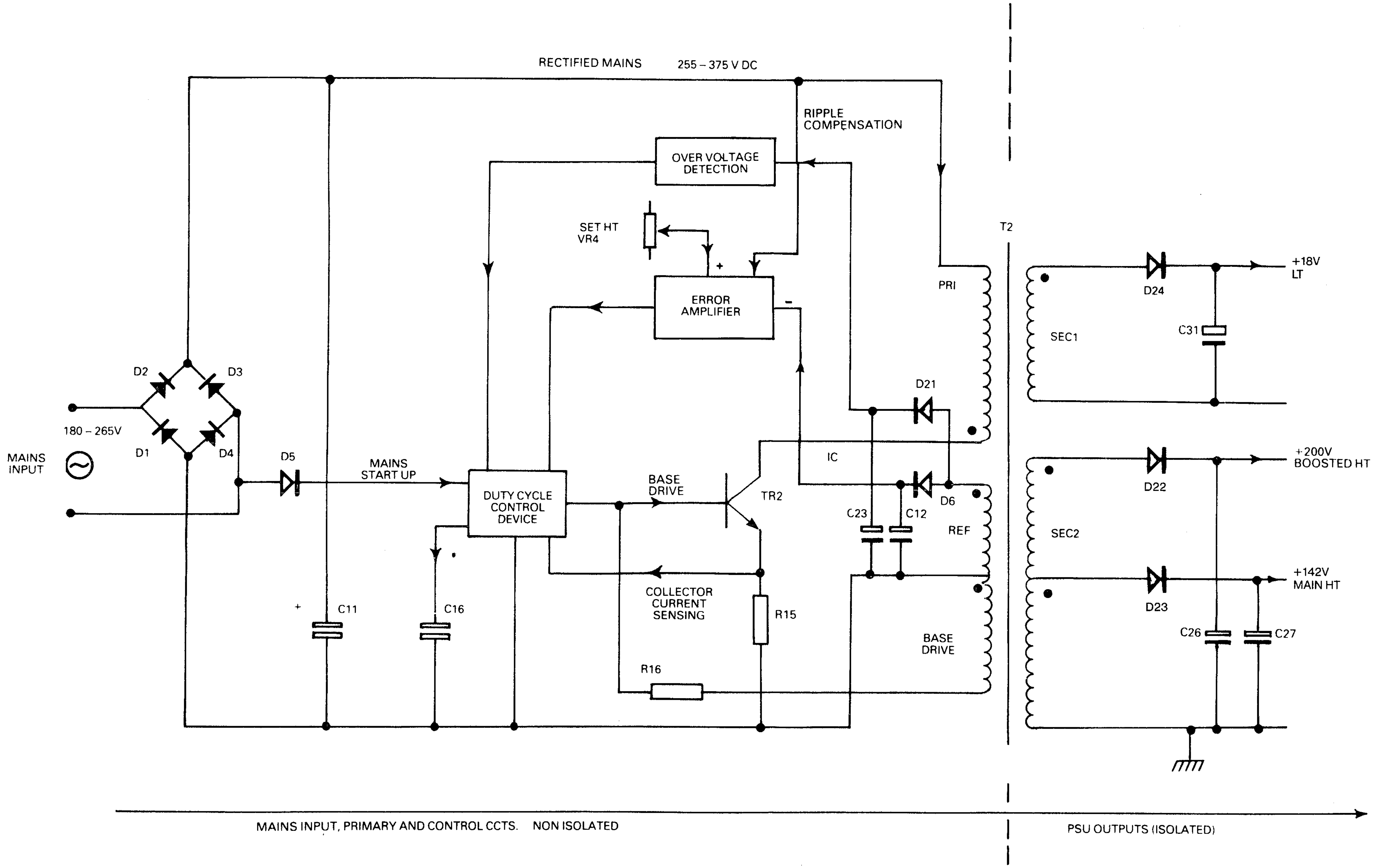

RECTIFIED MAINS
255 – 375 V DC
RIPPLE
COMPENSATION
OVER VOLTAGE
DETECTION
SET HT
VR4
+
ERROR
AMPLIFIER
-
T2
PRI
SEC1
D24
C31
+18V
LT
D2
D3
D1
D4
180 – 265V
MAINS
INPUT
D5
MAINS
START UP
DUTY CYCLE
CONTROL
DEVICE
BASE
DRIVE
TR2
IC
D21
D6
C23
C12
REF
BASE
DRIVE
+200V
BOOSTED HT
D22
SEC2
+142V
MAIN HT
D23
C26
C27
+
C11
C16
COLLECTOR
CURRENT
SENSING
R15
R16
MAINS INPUT, PRIMARY AND CONTROL CCTS. NON ISOLATED
PSU OUTPUTS (ISOLATED)

FIG. 1 SWITCHED MODE POWER SUPPLY CONCEPT : SIMPLIFIED CIRCUIT DIAGRAM

VIDEO
INPUT INTERFACE

VIDEO INPUT INTERFACE CIRCUIT

INPUT

Connections are made at PL101-red, green and blue video, sync options 1, 2, 3 and TTL video normal/invert. All inputs are flashover protected by resistors and diodes. R,G,B drives are split in two ways:

1. Test selectable links PL103, R,G,B.
2. To IC101.

TEST SELECTABLE LINKS PL103

SELECT POSITION 1

The input stage is in the linear mode, the video is buffered and level shifted by emitter output stages. These provide temperature tracking with TR103, 104 and 105 resulting in a stable black level.

NOTE

In the linear mode only brightness variations of the video information are possible using VR314.

SELECT POSITION 2

TR103, 104 and 105 bases are driven by IC101. This option is used when driving from TTL video sources offering primary/secondary colour and black and white drives.

NOTE

In the TTL mode, signal to noise immunity of system is very good. IC101 can be used with negative TTL level video drives (R,G,B), in order to invert video information.

Video inversion is achieved by toggling video polarity select line at PL101 pin 2 or TL101:

Normal - 0V
Invert - +5V

TTL MODE

Contrast of video information is tracked by varying available potential across open collector load resistors, R114, 115 and 116 which are supplied by TR101 from +12V, the base being driven from the contrast control slider VR111. R112, C101 form a low pass filter and ensure smooth operation of contrast control.

CRT BEAM CURRENT

Information is fed to D117, 118, from a constant current source derived from 124V main HT rail. As CRT beam current increases D117, 118 junctions become more negative thus: D117 conducts more heavily causing voltage to TR106 base to decrease. R136, C105 filter the signal, the derived voltage is emitter followed and supplies TR103, 104 and 105 emitters directly. Hence increases in CRT beam current, above a preset limit achieving an automatic reduction in picture brightness.

NOTE

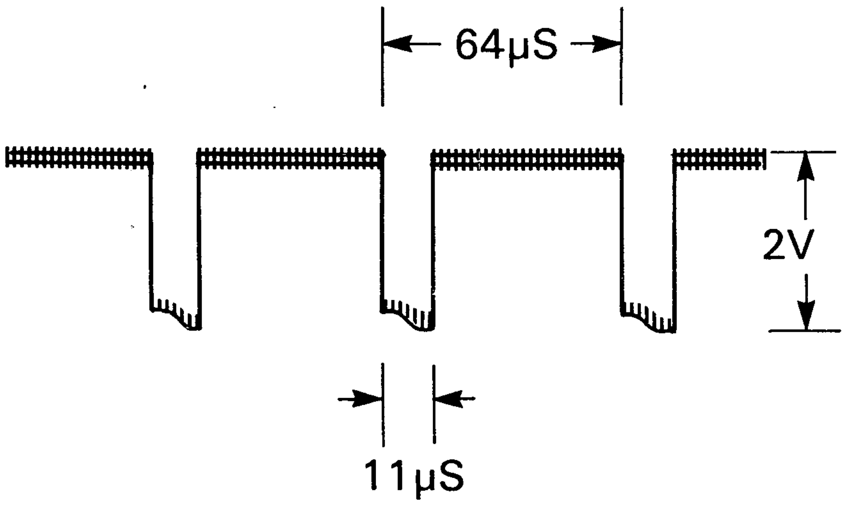
CRT beam limiting is preset depending on monitor model.

Brightness of display in all modes is adjusted by VR134 enabling parallel adjustment of R,G,B and black levels within a + or −20V range from nominal:

400uA - High and medium resolution
700uA - 14″ standard resolution TTL/Linear
900uA - 20″ standard resolution TTL/Linear

TR102

A fast switching transistor used to derive mixed blanking pulses for flyback blanking of video information. The base is driven from a potential divider/mixer network, from a line flyback pulse and a frame flyback pulse. Line flyback is advanced in phase with C225, to allow for transistor switching delays. D107 holds TR102 in a semi-saturation state.



TR102 COLLECTOR

IC101

IC101 is also used to provide the following sync options:

COMPOSITE NEGATIVE SYNC

Fed in on PL101, pin 7, ensure TL102 in non-active position, allowing pin 2 of IC101, to be pulled high whereupon IC101 performs a sync inversion and provides an attenuated positive sync waveform for driving sync separators of IC201, via R201 and TL106.

COMPOSITE POSITIVE SYNC

Fed in on PL101, pin 7 with TL102 in its grounded position. IC101, now provides an output in phase with input and of suitable amplitude for driving IC201 directly, via R201 and TL106.

SEPARATE NEGATIVE LINE AND FIELD SYNCS

Ensure TL102 in non-active position, line syncs are fed in on PL101, pin 5. IC101 performs an exclusive OR function, the output being an inverted composite sync waveform.

SEPARATE POSITIVE LINE AND FIELD SYNCS

Fed in on PL101, pin 7 in its grounded position. TL106, is switched over to inverse field option. IC101, provides an attenuated and buffered line sync feed for IC201, via R201. Positive field sync information is fed directly PL101, pin 3 'sync 3' input by TL106(B) and R202.

LINE TIMEBASE

LINE TIMEBASE

CIRCUIT DESCRIPTION (See FIG. 1)

LINE TIMEBASE

Line oscillator function is based on IC201, providing three outputs:

1. Horizontal drive pulses for control of line output stage.
2. Vertical sync pulses compatible with synchronisation of IC301 field output IC.
3. A sandcastle pulse providing burst gate and clamp information.

NOTE

This facility is only used with IC TDA3301, currently required by '1 volt 75 ohm' linear/PAL input monitors.

SYNC SEPARATOR

IC201 (TDA1189P), incorporates separate noise gated sync separators for line/field syncs, which accepts positive going sync pulses (or negative going composite video) on pins 8 and 9.

Output pulses from the line sync separator are used in conjunction with a sync gate to synchronise line oscillator in a phase locked loop circuit.

LINE OSCILLATOR - PHASE DETECTORS

The line oscillator is timed by a network of resistors and capacitors on pins 14 and 15 of IC201, used to derive a pulse of suitable mark space ratio for driving line output stages.

IC201 contains two basic control loops, each containing a phase detector.

1. The first phase detector compares output of the line oscillator with the incoming line sync pulse. Phase detector output on pin 13 is filtered and fed to the voltage control input of the oscillator on pin 15.
2. The second phase detector, compensates for delays introduced by the line output stage and compares line flyback pulses at pin 6 with oscillator output. Phase detector output consists of a bi-directional current source used to charge/discharge C213 on pin 5. Voltage derived from C213 is used to control a phase shifter, which regulates the phase of the output pulse on pin 3. Pin 5 also provides a 'line shift' function, by offsetting voltage developed across C213 charged from VR220, R221 and R222 allowing phase shift of + or −1us, between line scan and video information.
3. A 7us gate pulse from the line oscillator, whose phase position is centred around the horizontal sync pulse. The gated pulse is used to control line arrival of sync pulses at the sync phase detector for a duration of 7us, allowing latching and de-latching of line oscillator. Obtained by a coincidence detector which compares the phase gate pulse with that of incoming syncs.
4. When the two signals are not aligned, the coincidence detector is used to switch p.l.l. filter into a short time constant mode, giving a high input impedance at pin 12, thus increasing sensitivity and loop gain of oscillator. The phase locked loop now has a low noise immunity but has a very wide capture range. When aligned coincidence detector activates the time constant switch, causing low impedance on pin 12, achieving a lower sensitivity and loop gain, but providing a high degree of noise immunity. During the 'locked' condition the p.l.l. operates with a long time constant.

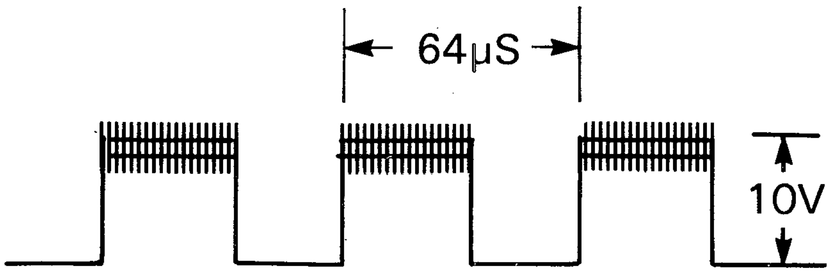
NOTE

A short time constant mode can be achieved manually by connecting the output of the coincidence detector on pin 11 to ground allowing the oscillator to follow rapid fluctuations in line period, which may occur on some non-standard signals.

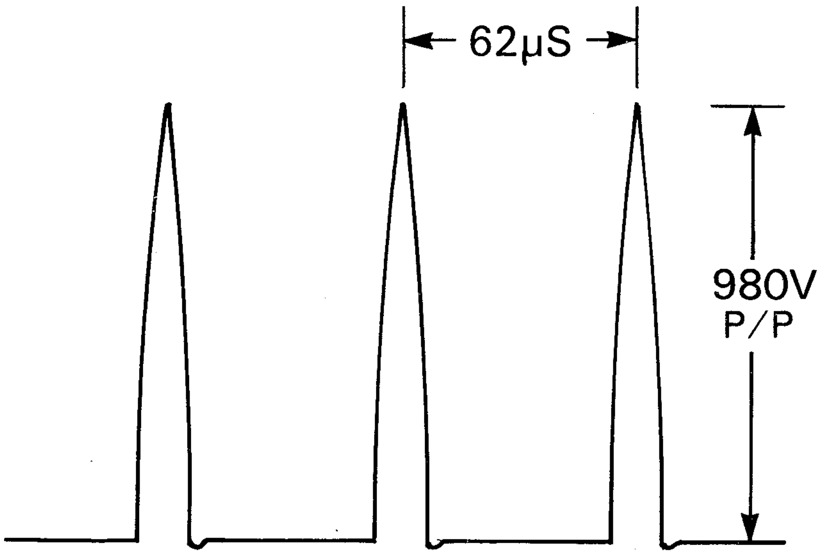
LINE TIMEBASE

LINE DRIVER STAGE

Horizontal drive pulses from pin 3 (IC201) are DC coupled to TR201 and used to control driver transformer (T201), providing the impedance conversion necessary to provide 600mA forward base current, for saturation of line output transistor (TR202). Ringing is damped by R225 and C214 at TR201 turn off, thus limiting its Vce to a safe value. HT supply to the line driver comes from main HT supply rail, prior to E231 and HT scan interlock (PL201 pins 5/6) allowing its operation to be checked independently of the line output stage.



IC201 Pin 3



TR202 COLLECTOR

VERTICAL SYNC OUTPUT

Output of field sync separator is used to drive vertical sync output stage on pin 10 (IC201).

In addition, this pulse is used internally to inhibit the first phase detector during the field sync period, thus preventing 'top flutter' as a result of equalising pulses.

SANDCASTLE PULSE

Sandcastle pulse is on pin 7 (IC201), used on models with linear interface PCB assembly consisting of two sections.

1. Upper portion, suitable for burst gate and clamping operations from the horizontal oscillator, thus ensuring an accurate phase relationship with the video information.
2. Lower portion, derived from a line flyback 'slice' for line blanking.

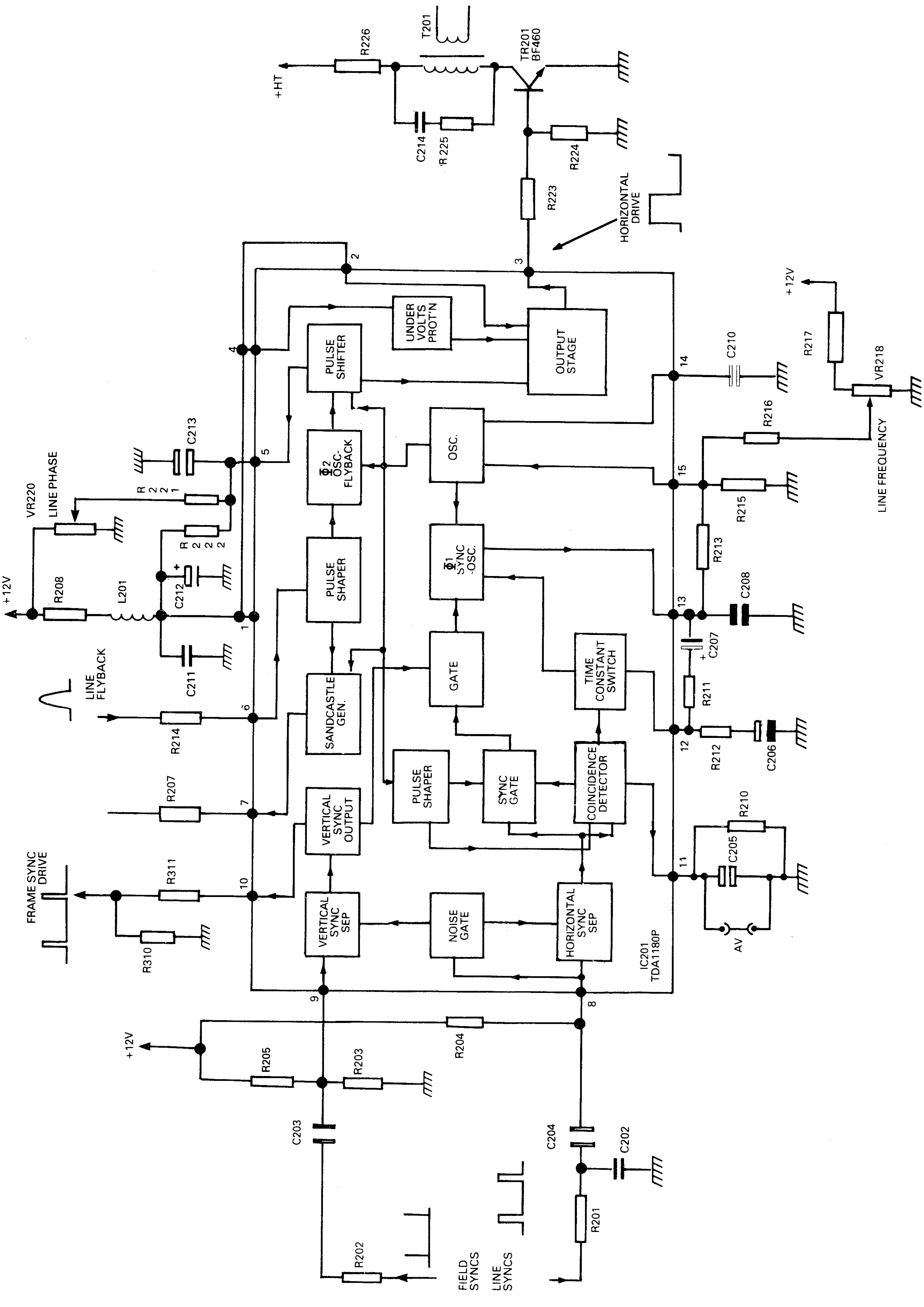

+HT
R226
T201
TR201
BF460
C214
R225
R224
R223
HORIZONTAL DRIVE
2
3
UNDER VOLTS PROT'N
OUTPUT STAGE
PULSE SHIFTER
4
14
C210
+12V
R217
VR218
R216
LINE FREQUENCY
Φ2 OSC- FLYBACK
OSC.
5
C213
15
R215
R221
R222
VR220
LINE PHASE
+12V
R208
L201
C212
PULSE SHAPER
Φ1 SYNC -OSC.
R213
13
C208
1
C207
C211
LINE FLYBACK
6
R214
SANDCASTLE GEN.
GATE
TIME CONSTANT SWITCH
R211
12
R212
C206
R207
7
VERTICAL SYNC OUTPUT
PULSE SHAPER
SYNC GATE
COINCIDENCE DETECTOR
R210
C205
FRAME SYNC DRIVE
R311
10
11
AV
R310
VERTICAL SYNC SEP
NOISE GATE
HORIZONTAL SYNC SEP
IC201
TDA1180P
9
8
+12V
R204
R205
R203
C203
C204
C202
R201
R202
FIELD SYNCS
LINE SYNCS

FIG. 1 LINE TIMEBASE : SIMPLIFIED CIRCUIT DIAGRAM - IC201

LINE OUTPUT

LINE OUTPUT STAGE

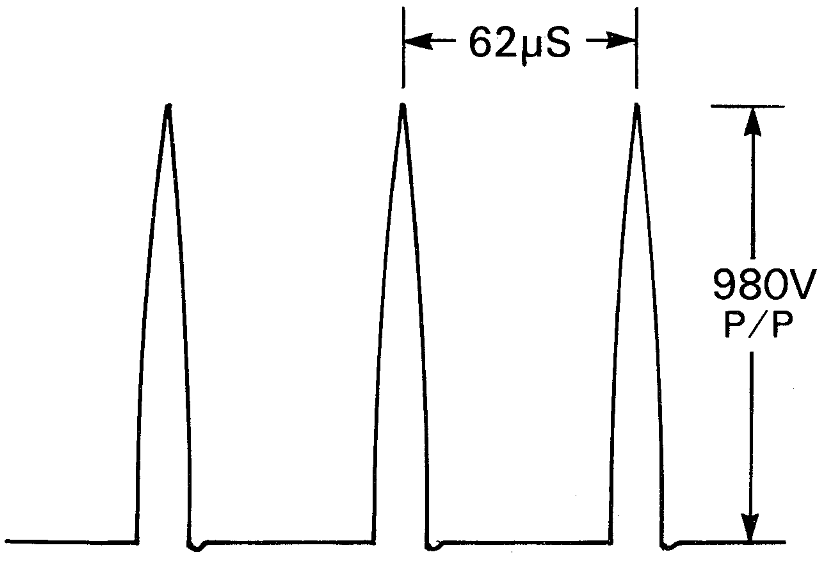
LINE OUTPUT (Refer to Main Circuit Diagram)

L202, L203 and T202 primary, are tuned during the flyback period by C222; this lasts for 11.8µs.

Line output transistor, TR202, is driven directly from the secondary winding of T201, 'ON' current is controlled by R227, turn off dissipation is minimised by L204

Line linearity correction is provided by L203, which is damped by C217, R230. 'S' correction is provided by C218.

Field timebase +25V (IC301), is achieved by rectifying a negative going flyback voltage from a secondary winding on line output transformer. A fusable resistor provides CRT protection under possible fault conditions.



TR202 COLLECTOR with 100 to 1 scope probe

EHT SUPPLY

The 23.5kV required for the CRT is generated by a tripler module driven from a 7.5kV overwind on transformer T203. Inductance of the transformer (between primary and overwind), is tuned to the 7th harmonic of the flyback frequency by tripler input capacitance and self capacitance of the overwind.

The 'breathing' performance of the display is further improved by deriving a high focus potential from a resistive thick film/substance potential divider from the EHT, giving rise to a constant bleed current from EHT, thus lowering output impedance of the EHT circuit.

An extra input diode within the tripler has its anode connected to the tube base ground and via a beam current sensing circuit to 0V. C223 and a network of resistors provide a load for the diode and effectively damp out ringing which may occur during scan. The resulting 1000V which occurs across C223 is used to generate A1 potential across CRT.

HT SUPPLY

The HT supply is derived from the main secondary winding of the switch mode power supply via R231. R231 is chosen to optimise picture breathing performance and offer protection to TR202, during CRT flashover.

FIELD TIMEBASE

FIELD TIMEBASE

CIRCUIT DESCRIPTION (refer to FIG. 1)

The field timebase function is carried out by IC301. Oscillator frequency is determined by VR307, R308 and C303, producing a 100us output pulse at pin 12. Field sawtooth is derived from potential across C305 and C306 as they change towards +25V supply via R304, R305, VR306 and R301. When field scan is completed the 100us pulse discharges C305 and C306, ready for charging cycle to be restarted.

FIELD LINEARITY

Sawtooth output on pin 1 of IC301 via R313 and VR312 (field linearity control).

FIELD FLYBACK

In order to achieve a short field flyback time, a supply voltage larger than required during scan must be applied to field deflection coils during flyback period. Made possible by using a separate field flyback generator, within IC301.

Main HT supply for IC301 is supplied to pin 5 via D302. During flyback the generator doubles the supply on pin 5, the potential on pin 3 is switched from 0V during scan to +25V during flyback. The change in voltage occurs on pin 5 via C304 causing potential to double during flyback.

D302 isolates pin 5 from +25V supply. When deflection coil field has collapsed and potential across field scan coils has fallen below +25V pin 3 is switched back to 0V and scan cycle resumed.

Synchronisation of IC301 is achieved by feeding a positive (going) field sync pulse on pin 8 of IC301.

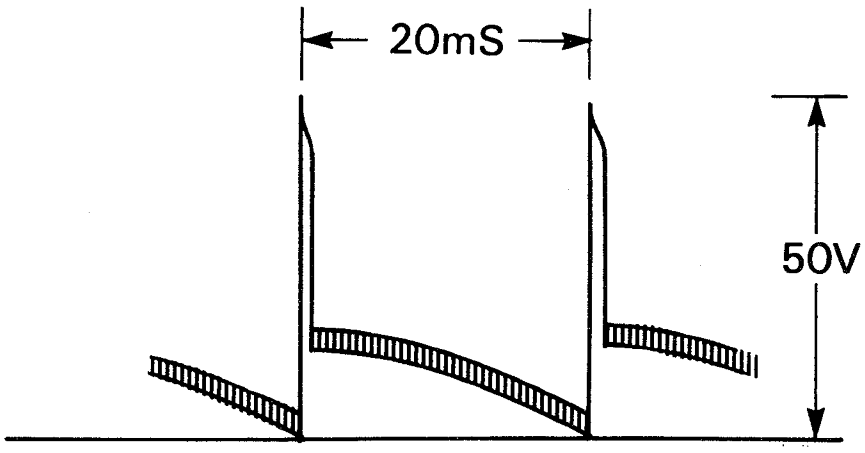
HT SUPPLY for IC301

HT for IC301 is derived from a scan rectified rail from the line output stage. C305, C306 are fed via VR306 (height control) from scan rectified supply and 12V rail. Proportions of current and associated time constants R303, C301 and DF301 are used to minimise "picture bounce" thus maintaining accurate tracking of the field scan with line scan amplitude during CRT beam current variations, therefore reducing picture "breathing" effects.

FIELD OUTPUT

Sawtooth output on pin 1 is applied to output stage (within IC301) and scan output is available from pin 4 to field deflection coils. Current within coils is sampled by R323, then fed back via R317 to the virtual earth input pin 10 of IC301.

Gain of output amplifier is set by the ratio of R314 and R317 and DC operating point by R318 and R316.



IC301 Pin 4 with 10 to 1 scope probe

PICTURE GEOMETRY

CRT E-W pincushion distortion is corrected by modulation of line deflection current in transductor (T202) actively driven by TR301, which is then fed from the parabolic waveform at the top of the S correction capacitor C311. AC gain from the amplifying driver is used to control amount of correction applied to CRT.

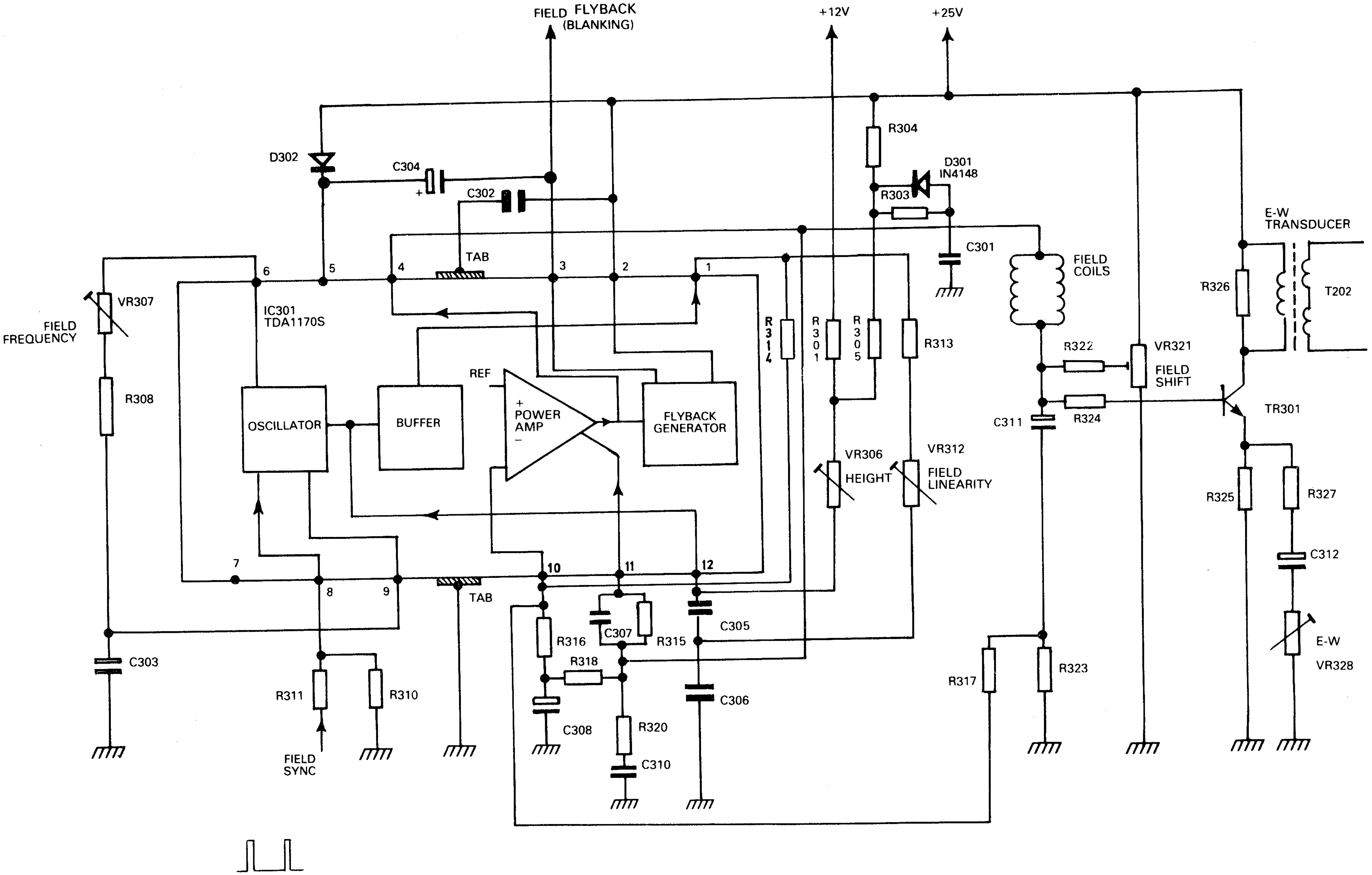

FIELD FLYBACK (BLANKING)
+12V
+25V
R304
D301
IN4148
R303
C301
D302
C304
+
C302
TAB
E-W TRANSDUCER
FIELD COILS
R326
T202
VR307
FIELD FREQUENCY
6
5
4
3
2
1
IC301
TDA1170S
R314
R301
R305
R313
R322
VR321
FIELD SHIFT
R308
REF
+
POWER AMP
–
OSCILLATOR
BUFFER
FLYBACK GENERATOR
TR301
C311
R324
VR306
HEIGHT
VR312
FIELD LINEARITY
R325
R327
C312
7
8
9
10
11
12
TAB
C307
R315
R316
C305
R318
E-W
VR328
C303
R311
R310
R323
R317
C306
C308
R320
C310
FIELD SYNC

FIG. 1 FIELD TIMEBASE : SIMPLIFIED CIRCUIT DIAGRAM - IC301

CRT TUBE BASE PANEL

CRT TUBE BASE PANEL

CRT TUBE BASE PANEL (refer to Main Circuit Diagram)

CIRCUIT DESCRIPTION

All CRT electrodes are protected by a resistor, capacitor and spark gap. Spark gaps on all electrodes (except focus) are formed by a 1-2kV ring trap gap, positioned within CRT base socket assembly. High focus voltage has a separate 10kV spark gap contained within tube base socket.

CRT cathodes are stood off from video outputs by 220 ohm resistors, the grid by 100k and A1's 820k. Decoupling of grid and A1's is achieved by C910 and C911.

Focus voltage is provided by a potential divider located within tripler module, providing an adjustable voltage of 5-8kV.

A1 voltage is adjusted by VR932, offering a range of 350-280 volts.

CRT heaters may be disconnected by removing TL901, in order to make video adjustments.

CRT cathodes are directly driven from video output stages mounted on CRT panel.

VIDEO OUTPUT STAGES - CIRCUIT DESCRIPTION AND OPERATION

NOTE

Red, Green and Blue video outputs are identical; the following text refers to the Red output stage.

TR902 forms a class 'A' amplifier, AC gain is derived from the ratio of R935 to R902, VR903 and DC gain by a DC offset current from R905 and VR906.

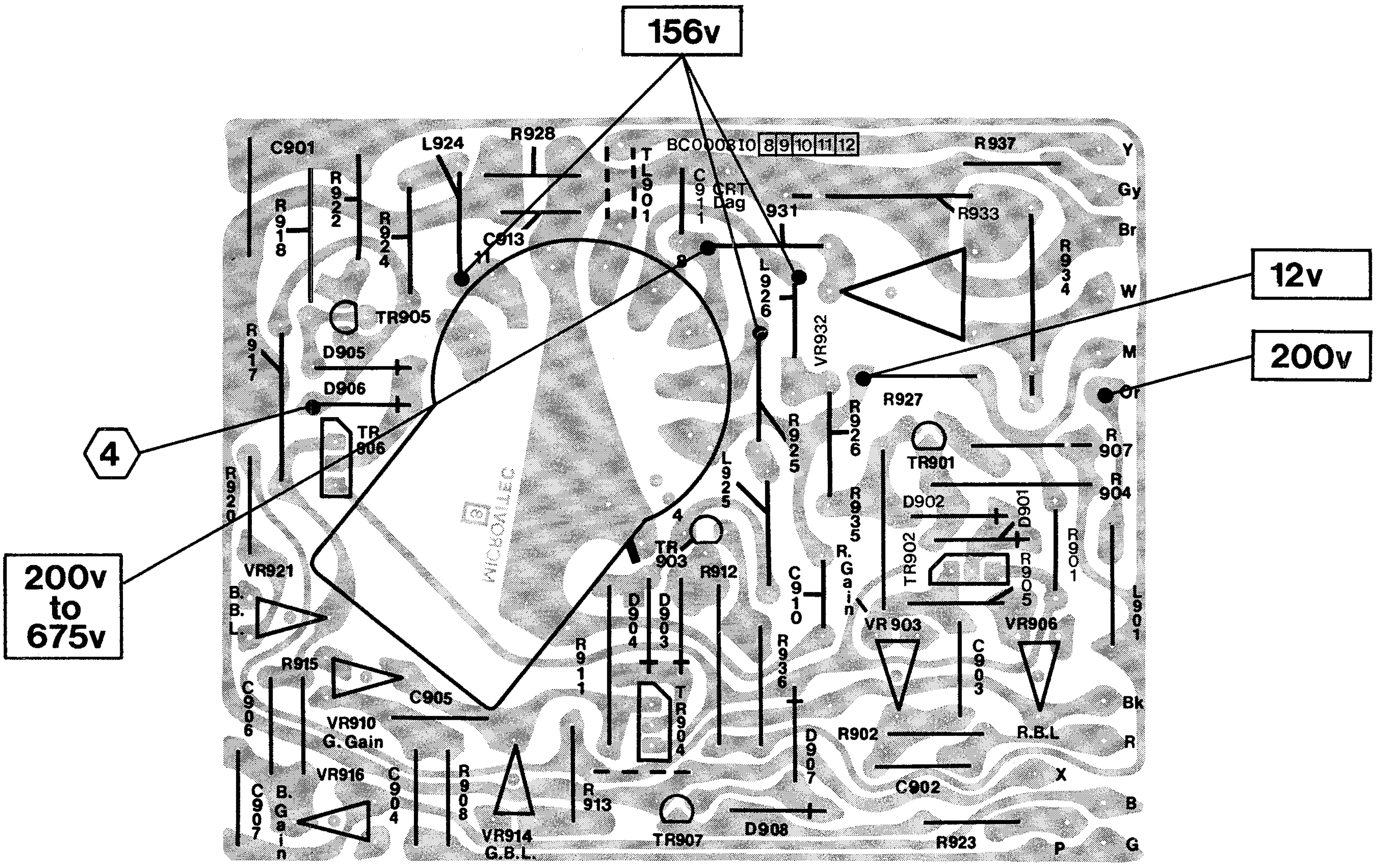
R904 forms video output load and TR902 represents a low impedance drive source to CRT input capacitance during its conduction. During turn off of TR902, the source impedance of the load R904 is considerably reduced by TR901, ensuring a good 'pull-up' performance.

Video compensation is achieved by split capacitances, C902, C903 to help maintain a constant amplifier response curve over the full range of VR903.

The emitters of TR902, TR904 and TR906 are connected together with a DC reference of approximately 7.5V, used to set video black level voltage.

TR907 performs field blanking of video information.

1. TR907 is driven by negative (going) blanking pulses from TR102, TR907 conducts providing a 7.5V black level reference.
2. During field flyback TR907 is turned off, forcing video outputs off.
3, Beam current information is sensed on tube base panel resistively, across line output ground to 0V line by R937, D117, D118 on main PCB.


156v
12v
200v
4
200v
to
675v
C901
L924
R928
T L901
BC000310
8
9
10
11
12
R937
Y
Gy
Br
W
M
Or
R918
R922
R924
C913
11
C911
CRT Dag
931
R933
R934
TR905
8
L926
D905
D906
VR932
R927
R917
TR 906
R925
R926
R935
TR901
R907
R904
R920
L925
D902
D901
R901
VR921
4
TR 903
R912
R. Gain
TR902
R905
L901
B. B. L.
D904
D903
R911
R936
C910
VR 903
VR906
R915
C905
C903
C906
VR910 G. Gain
TR904
D907
R902
R.B.L
Bk
R
VR916
C904
R908
R913
C902
X
C907
B. Gain
VR914 G.B.L.
TR907
D908
R923
B
P
G
MICROVITEC

⬡ DENOTES TEST WAVEFORM MEASURING POINT

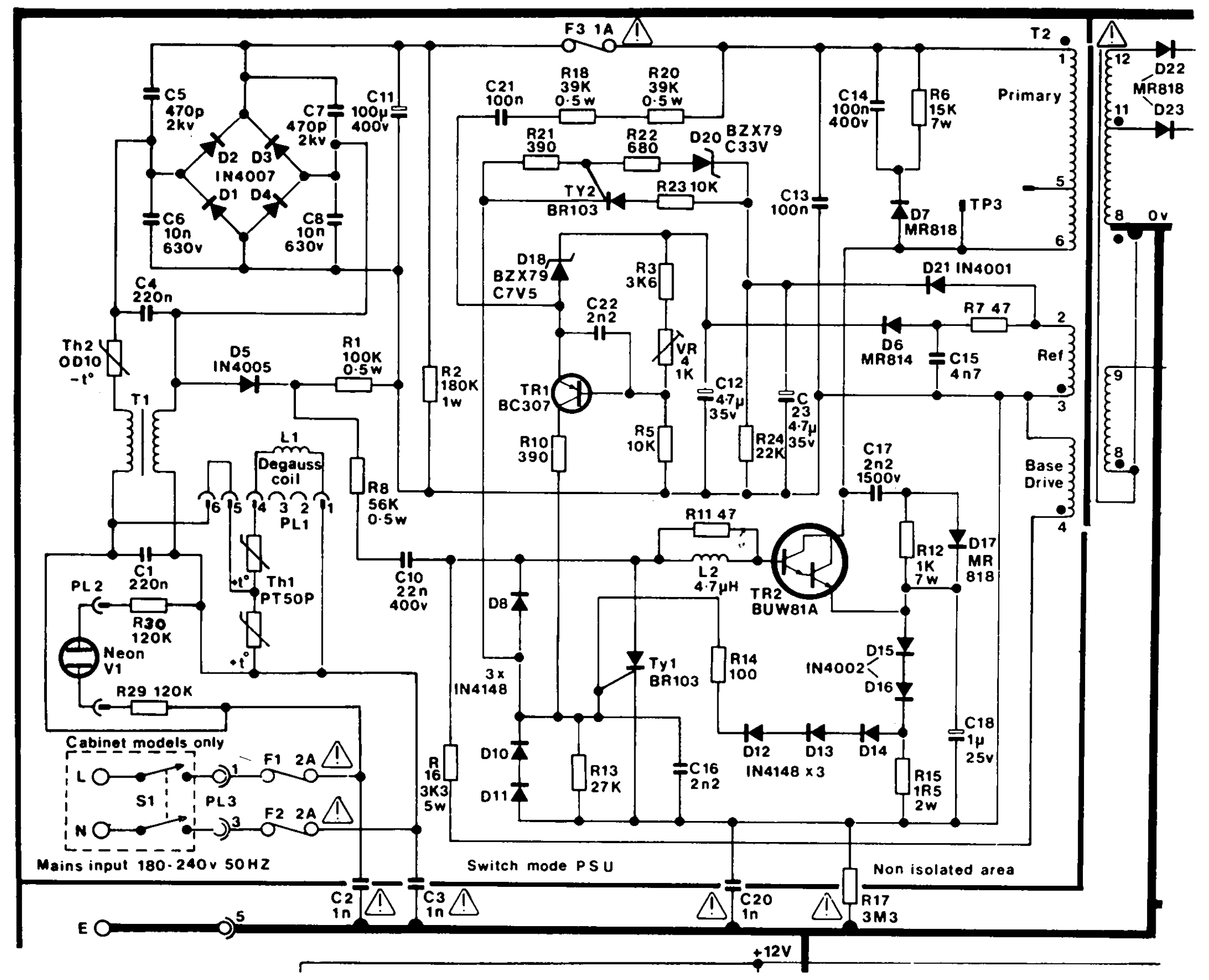
▭ DENOTES TEST VOLTAGE MEASURING POINT

SERIES 3 CRT TUBE BASE PANEL - TRACK (SOLDER) SIDE VIEWED THROUGH PCB FROM COMPONENT SIDE

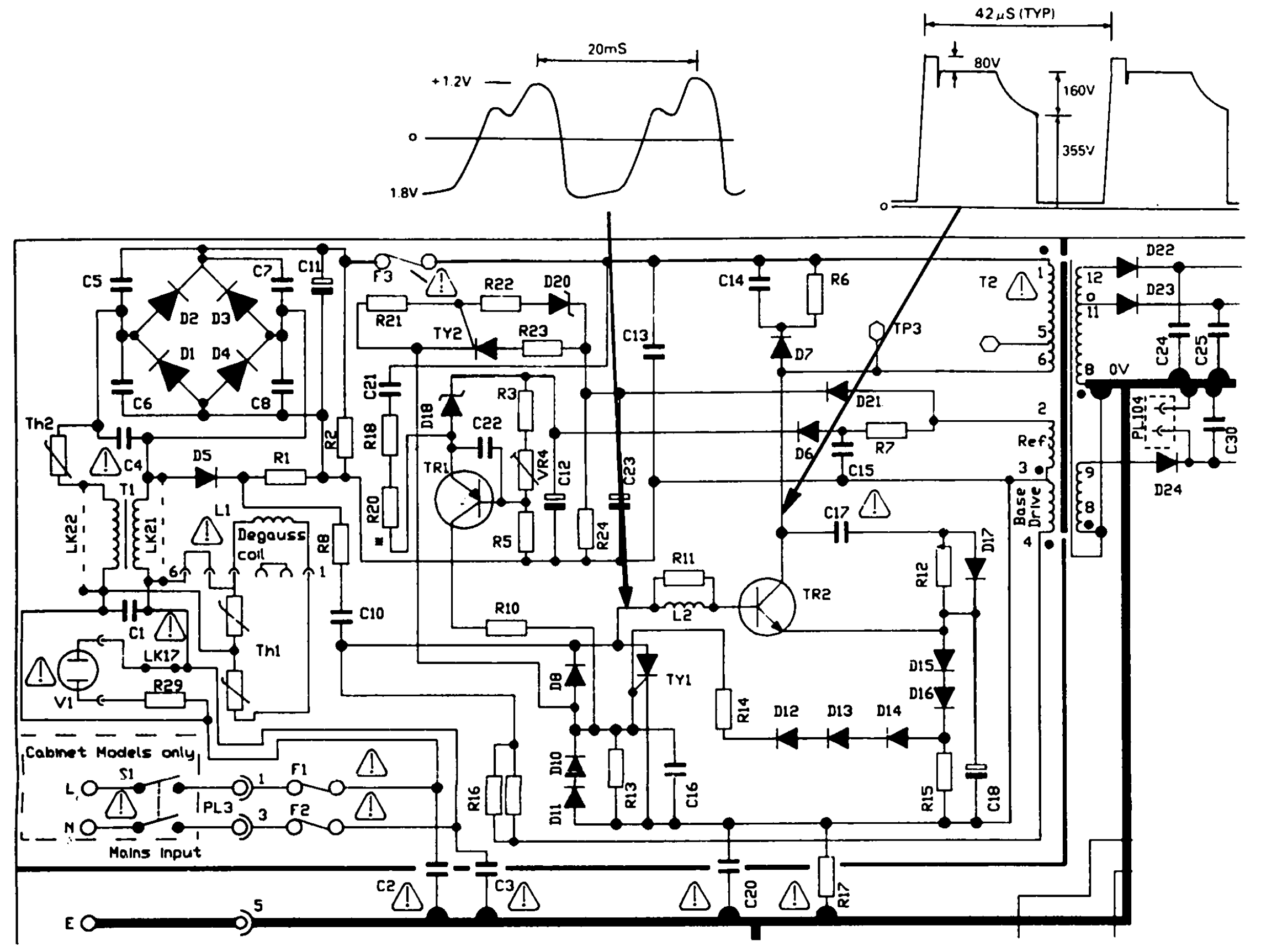
DRIVE DEFLECTION
BOARD

DRIVE DEFLECTION PCB

EARLIER POWER SUPPLIES


Switch mode PSU
Non isolated area
Mains input 180-240v 50HZ
Cabinet models only
Primary
Ref
Base Drive
Degauss coil

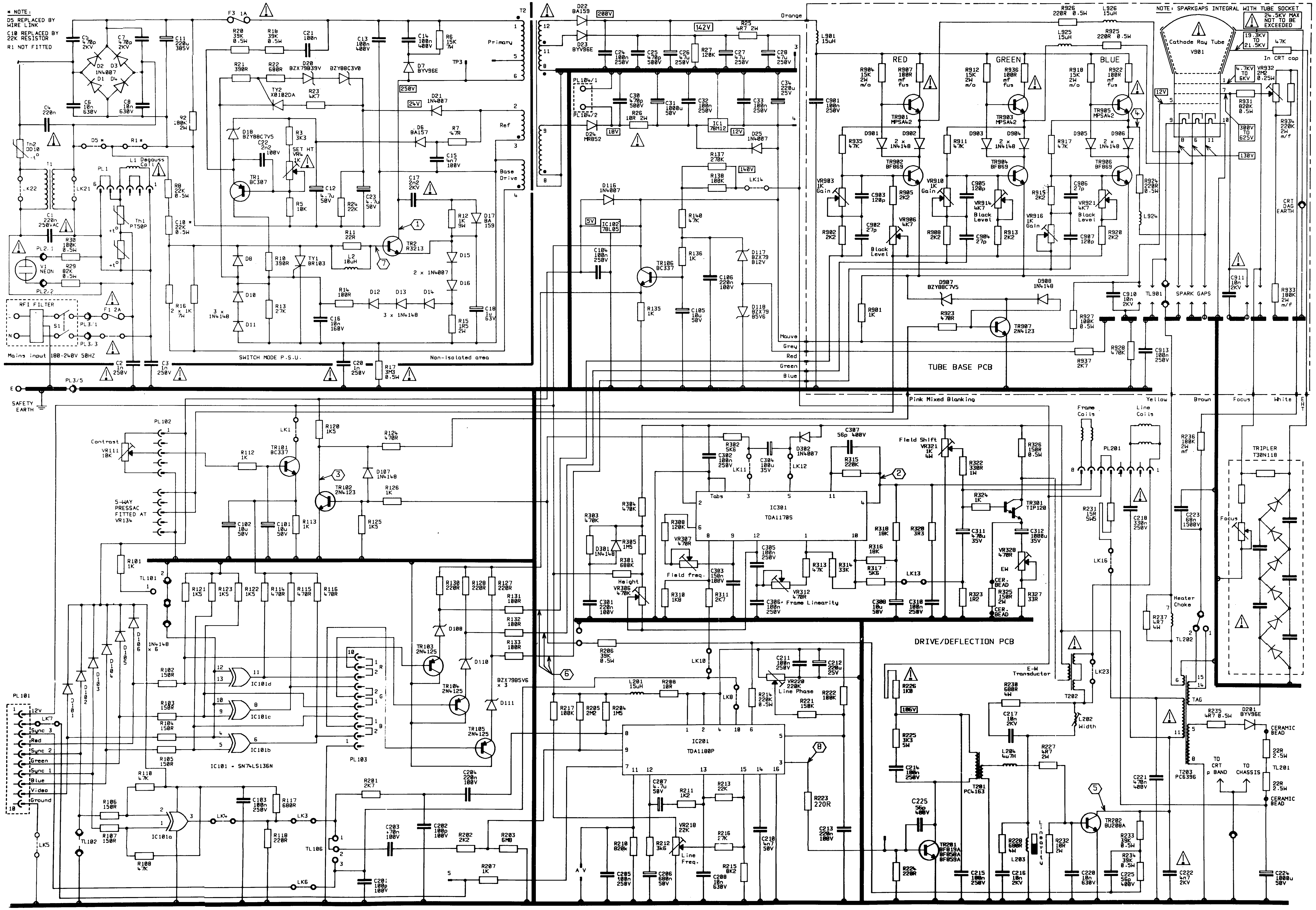
MK I


20mS
42µS(TYP)
Cabinet Models only
Mains input

MK II

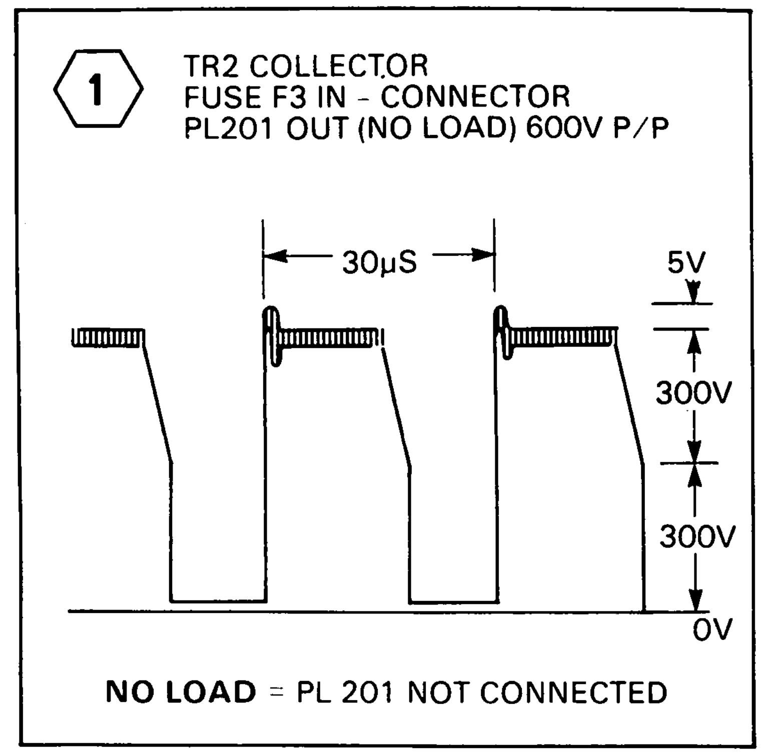
*NOTE
THE LATEST SERIES 3
POWER SUPPLY DIFFERS
FROM THE PREVIOUS BY
THE FOLLOWING:

R1 REMOVED
D5 REMOVED AND LINK FITTED
C10 NOW 22K ½W
R8 M/FILM RESISTOR

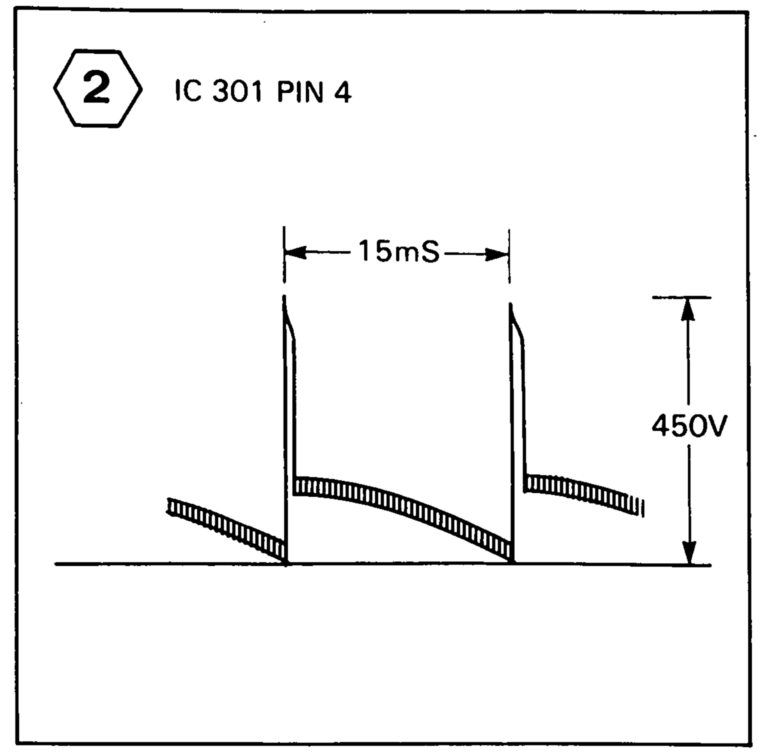

* NOTE:
D5 REPLACED BY WIRE LINK
C10 REPLACED BY 22K RESISTOR
R1 NOT FITTED
RFI FILTER
Mains input 100-240V 50HZ
SWITCH MODE P.S.U.
Non-isolated area
SAFETY EARTH
NOTE: SPARKGAPS INTEGRAL WITH TUBE SOCKET
Cathode Ray Tube
V901
RED
GREEN
BLUE
SPARK GAPS
TUBE BASE PCB
DRIVE/DEFLECTION PCB
Pink Mixed Blanking
Frame Coils
Line Coils
IC301 TDA1170S
IC201 TDA1180P
IC101 = SN74LS136N
5-WAY PRESSAC FITTED AT VR134
Contrast
Field Shift
Field Freq.
Height
Frame Linearity
Line Phase
Line Freq.
Width
E-W Transducer
Heater Choke
TRIPLER T30N118
Focus
TO CRT p BAND
TO CHASSIS
CERAMIC BEAD
CRT DAG EARTH

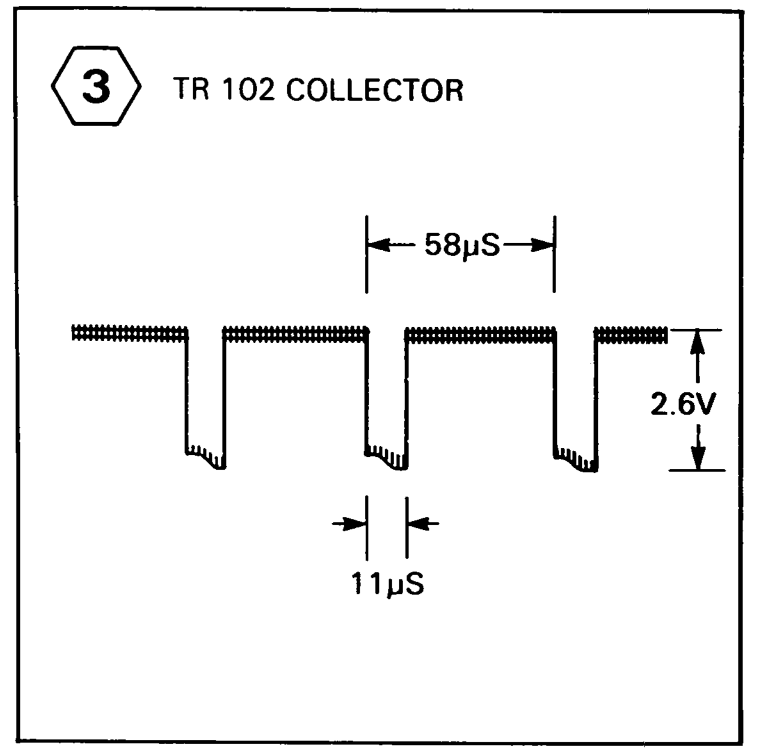
NOTE: REFER TO THE KEY NOTES INCLUDED ON THE 'WAVEFORMS' DIAGRAM

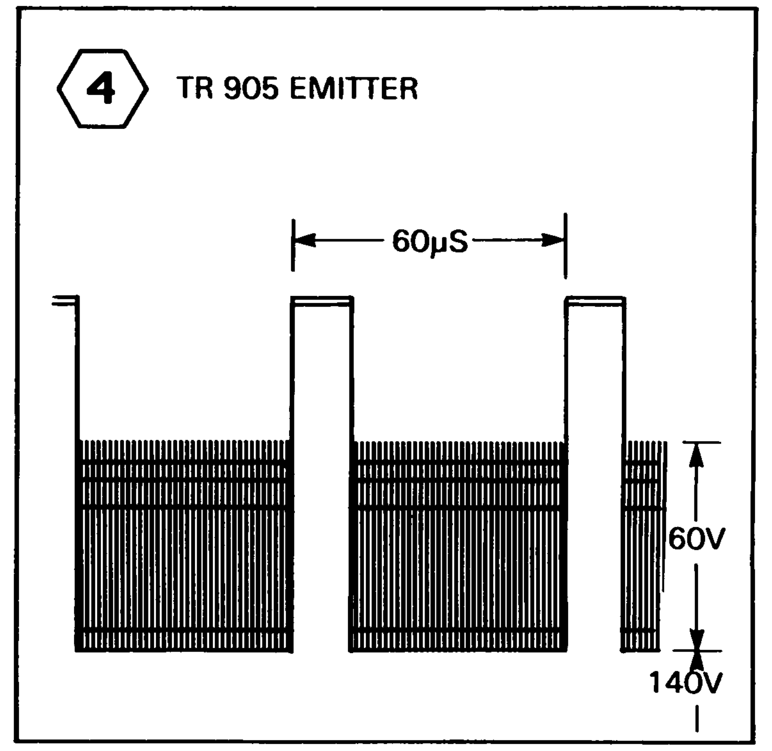
**SERIES 3
DRIVE/DEFLECTION
AND TUBE BASE
PCB CIRCUIT DIAGRAM**

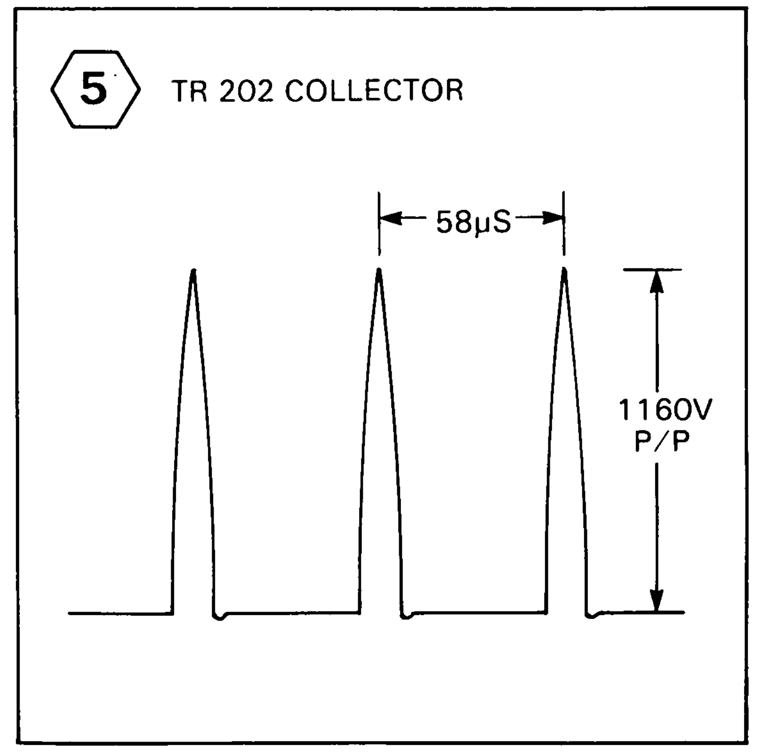

1 TR2 COLLECTOR
FUSE F3 IN - CONNECTOR
PL201 OUT (NO LOAD) 600V P/P

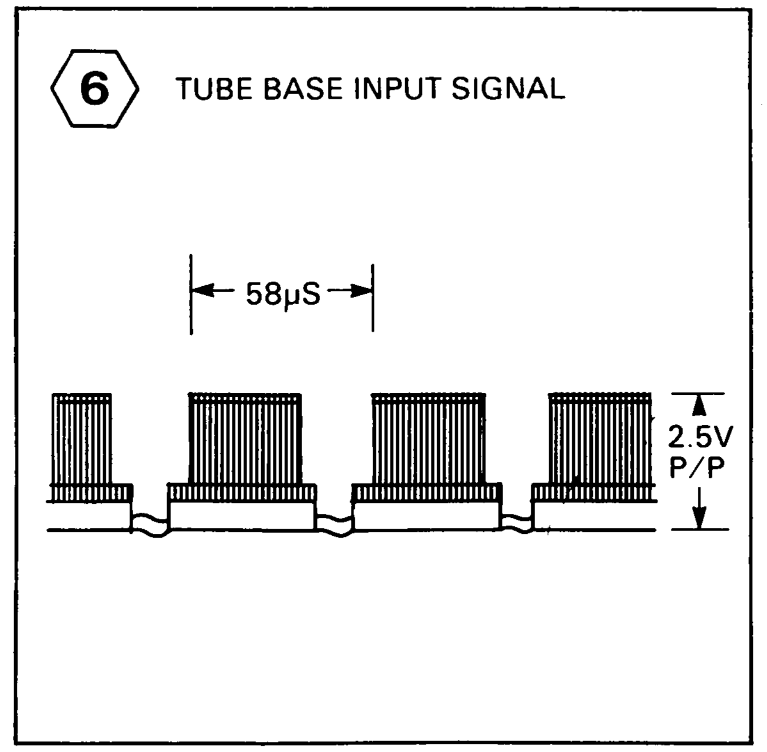
NO LOAD = PL 201 NOT CONNECTED

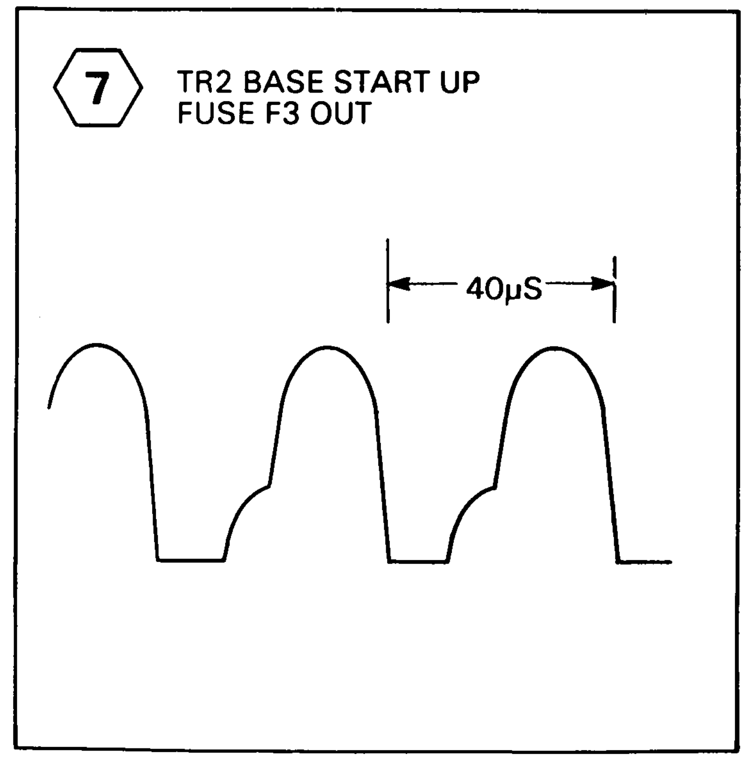

2 IC 301 PIN 4

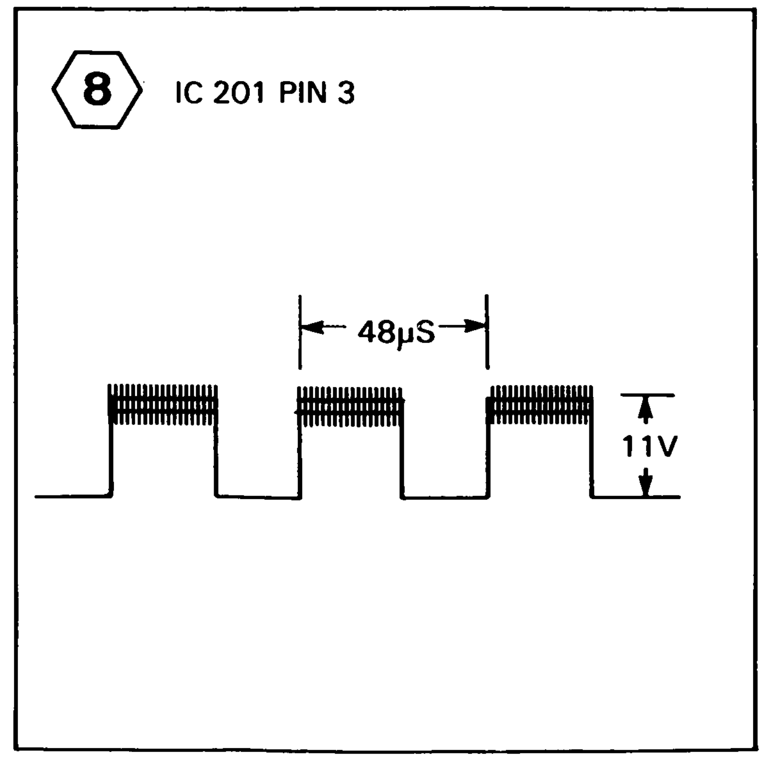

3 TR 102 COLLECTOR


4 TR 905 EMITTER


5 TR 202 COLLECTOR


6 TUBE BASE INPUT SIGNAL


7 TR2 BASE START UP
FUSE F3 OUT


8 IC 201 PIN 3

SAFETY AND ISOLATION!

The power supply is always live regardless of the mains supply polarity. Therefore for servicing, the monitor should be supplied through a mains Isolation Transformer of at least 300VA rating.
(See 'SAFETY NOTES' in SERVICE MANUAL).

SAFETY CRITICAL COMPONENTS

Components marked ⚠ on the circuit diagram and parts list are safety approved types and should only be replaced with components supplied or approved by our Service Department. It is recommended that other replaced parts should be of the type originally fitted, particularly resistors stood off the printed circuit boards.
FAILURE TO OBSERVE THE ABOVE MAY RENDER THE CHASSIS AND EXTERNAL ACCESSIBLE PARTS LIVE, OR CAUSE OTHER HAZARDS!

WAVEFORM MEASUREMENT POINTS

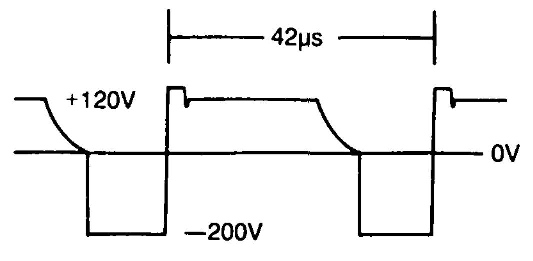
Waveform points are denoted thus ⟨3⟩

1) The numerical reference point on the circuit diagram relates to the corresponding numbered display on the accompanying table.
2) Waveform measurements were made using an oscilloscope of 20MHz minimum bandwidth and a ÷10 or ÷100 passive probe.

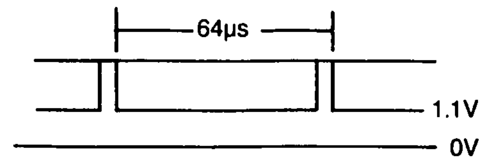
TYPICAL VOLTAGES - MEASUREMENT POINTS

1) Voltages denoted thus $\boxed{3.0V}$ on the circuit diagram, are typical voltages only, and were measured using ahigh input impedance D.V.M.
2) Alternatively, Analogue meters of 20 KΩ/Volt minimum can be used.

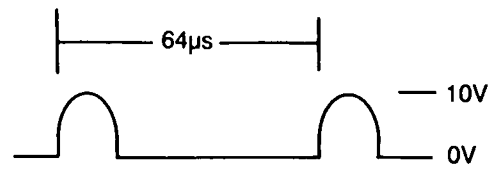
⑨ TEST POINT — D23 ANODE
Isolated secondary voltage drive winding (D23 anode). X100 probe.



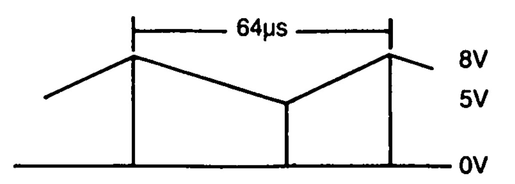
⑩ TEST POINT — IC201 PINS 8 AND 9
Mixed sync pulses at line rate. X10 probe.



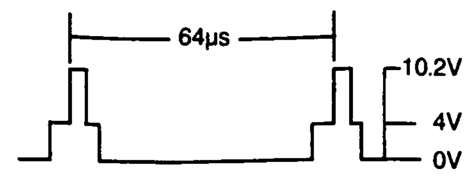
⑪ TEST POINT — IC201 PIN 6
Line flyback ref. pulse. X10 probe.



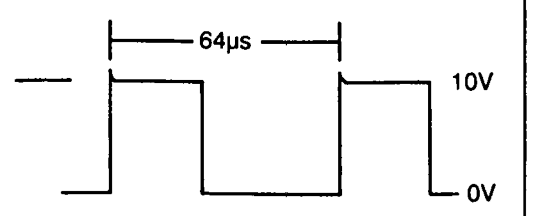
⑫ TEST POINT — IC201 PIN 14
Line oscillator. X10 probe.



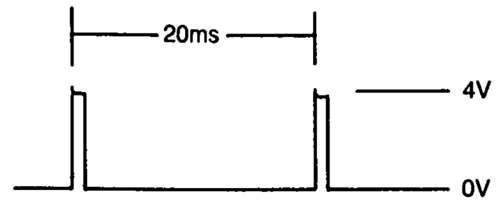
⑬ TEST POINT — IC201 PIN 7
Sandcastle pulse. X10 probe.



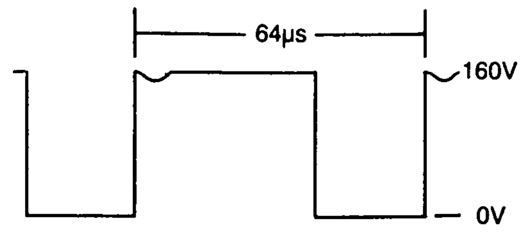
⑭ TEST POINT — IC201 PIN 3
Line drive information. X10 probe.



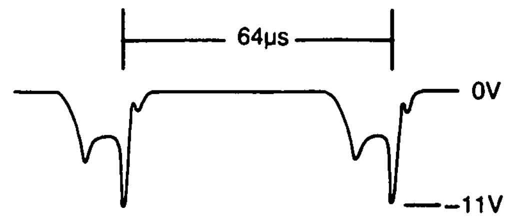
⑮ TEST POINT — IC201 PIN 10
Field sync. output. X10 probe.



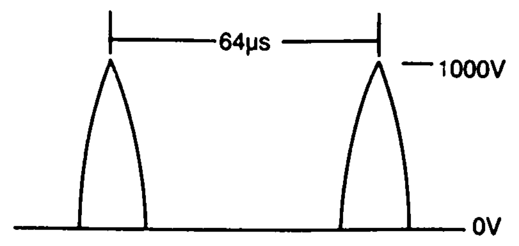
⑯ TEST POINT — TR201
TR201 Collector line driver primary waveform. X100 probe.



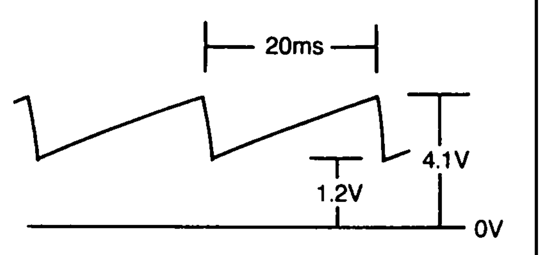
⑰ TEST POINT — TR202 BASE
Line output transistor base drive voltage. X10 probe.



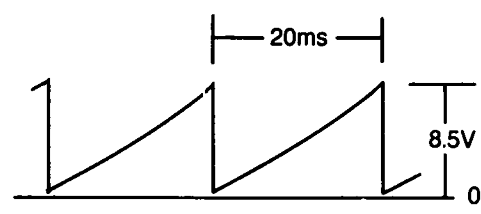
⑱ TEST POINT — TR202 COLLECTOR
Line output transformer collector -emitter voltage. X100 probe.



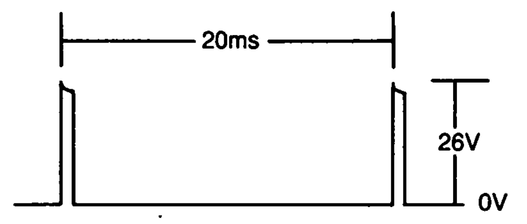
⑲ TEST POINT — IC301 PIN 9
Field oscillator waveform. X10 probe.



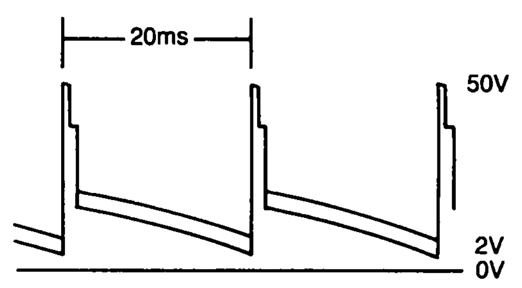
⑳ TEST POINT — IC301 PIN 12
Ramp generator. X10 probe.



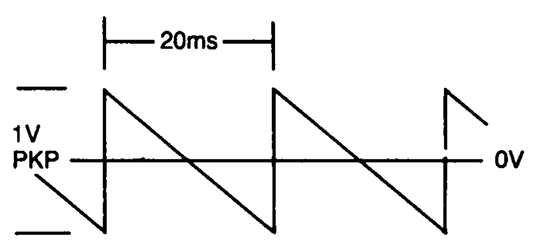
㉑ TEST POINT — IC301 PIN 3
Field flyback generator. X10 probe.



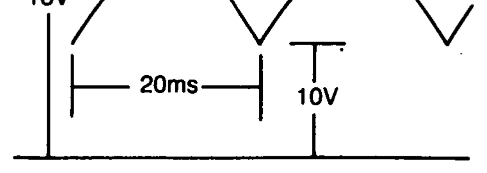
㉒ TEST POINT — IC301 PIN 4
Field output waveform. X10 probe.



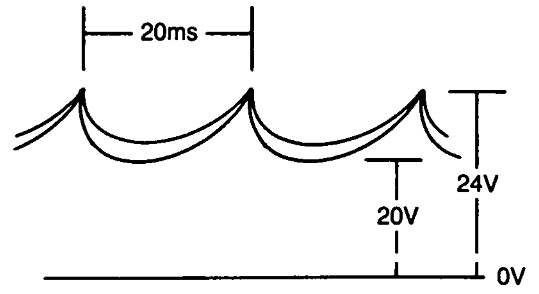
㉓ TEST POINT — CHECK ON R323
Field coils (Sawtooth current). X10 probe.



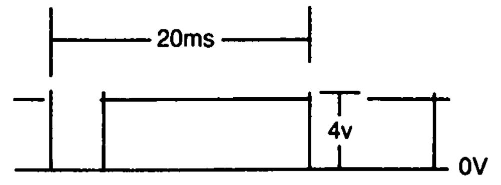
㉔ TEST POINT — TR301 BASE
Field parabola waveform. X10 probe.



㉕ TEST POINT — TR301 COLLECTOR
E-W Transducer drive waveform. X10 probe.



㉖ TEST POINTS — PL101 PINS 4, 6, 8
Video inputs (Red, Green and Blue). X10 probe.



SAFETY AND ISOLATION!

The power supply is always live regardless of the mains supply polarity. Therefore for servicing, the monitor should be supplied through a mains Isolation Transformer of at least 300VA rating. (See 'SAFETY NOTES' in SERVICE MANUAL).

SAFETY CRITICAL COMPONENTS

Components marked ⚠ on the circuit diagram and parts list are safety approved types and should only be replaced with components supplied or approved by our Service Department. It is recommended that other replaced parts should be of the type originally fitted, particularly resistors stood off the printed circuit boards.
FAILURE TO OBSERVE THE ABOVE MAY RENDER THE CHASSIS AND EXTERNAL ACCESSIBLE PARTS LIVE, OR CAUSE OTHER HAZARDS!

WAVEFORM MEASUREMENT POINTS

Waveform points are denoted thus ⟨3⟩

1) The numerical reference point on the circuit diagram relates to the corresponding numbered display on the accompanying table.
2) Waveform measurements were made using an oscilloscope of 20MHz minimum bandwidth and a ÷10 or ÷100 passive probe.

TYPICAL VOLTAGES — MEASUREMENT POINTS

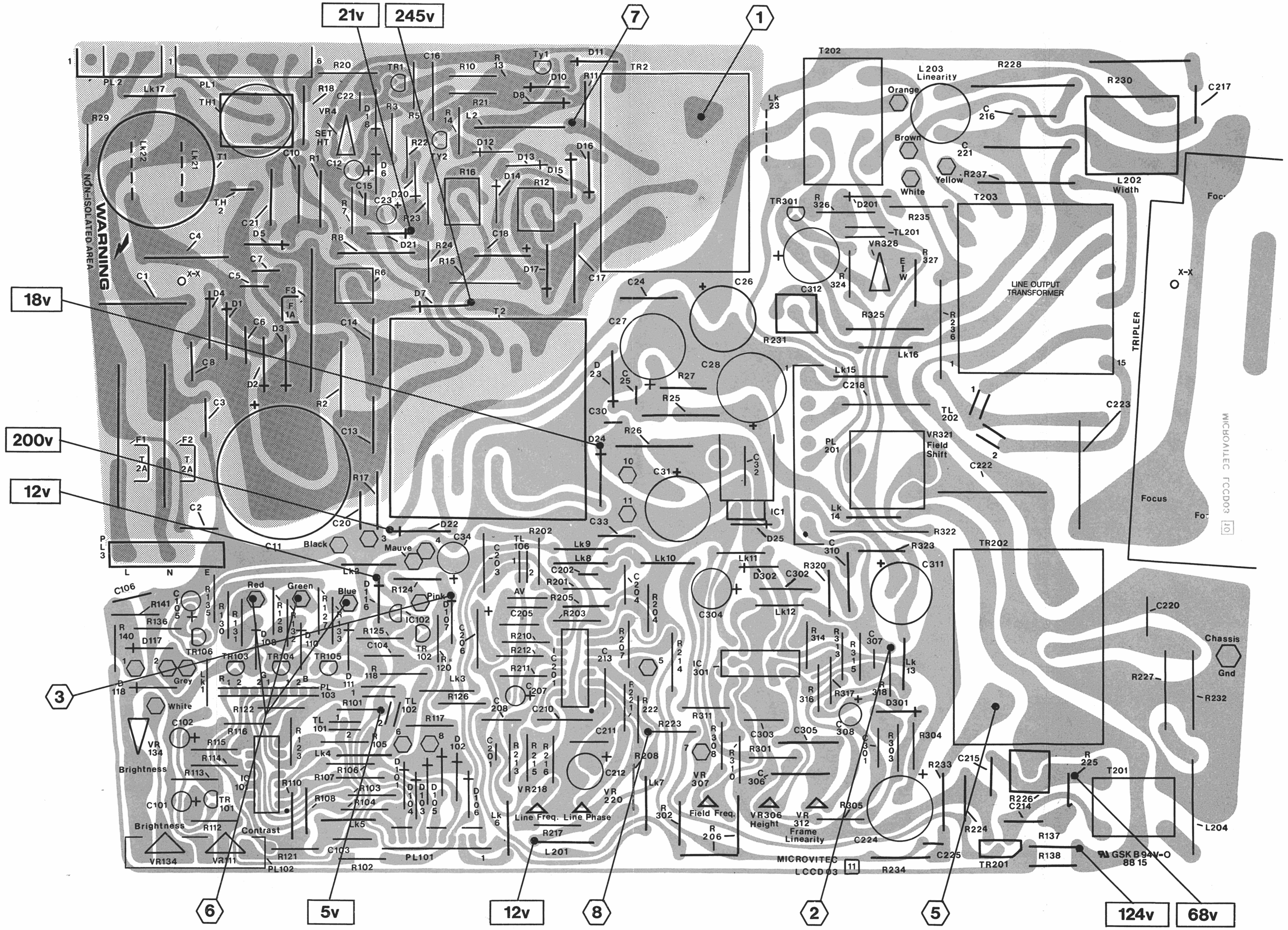
1) Voltages denoted thus $\boxed{3.0\text{V}}$ on the circuit diagram, are typical voltages only, and were measured using a high input impedance D.V.M.
2) Alternatively, Analogue meters of 20 KΩ/Volt minimum can be used.

NOTE

Waveform points denoted thus ③ are NOT shown on the circuit diagram. Component pin numbers are given as test points on the associated waveforms.

SERIES 3 WAVEFORMS (CONTINUED)

DRIVE/DEFLECTION PCB


21v
245v
7
1
18v
200v
12v
3
6
5v
12v
8
2
5
124v
68v
WARNING
NON-ISOLATED AREA
PL2
PL1
PL3
TH1
T1
T2
TR2
F1 T 2A
F2 T 2A
F3 F 1A
Black
Mauve
Red
Green
Blue
Pink
Grey
White
Brightness
Contrast
VR134
VR111
PL102
PL101
IC101
IC102
Line Freq.
Line Phase
L201
Field Freq.
VR306 Height
VR312 Frame Linearity
MICROVITEC LCCD03
TR201
T201
L204
GSK B 94V-O 88 15
Chassis Gnd
C220
R227
R232
TR202
Focus
TRIPLER
LINE OUTPUT TRANSFORMER
T203
T202
L203 Linearity
Orange
Brown
White
Yellow
L202 Width
R230
C217
R228
VR321 Field Shift
PL201
X-X
IC1
IC301

⬡ DENOTES TEST WAVEFORM MEASURING POINT

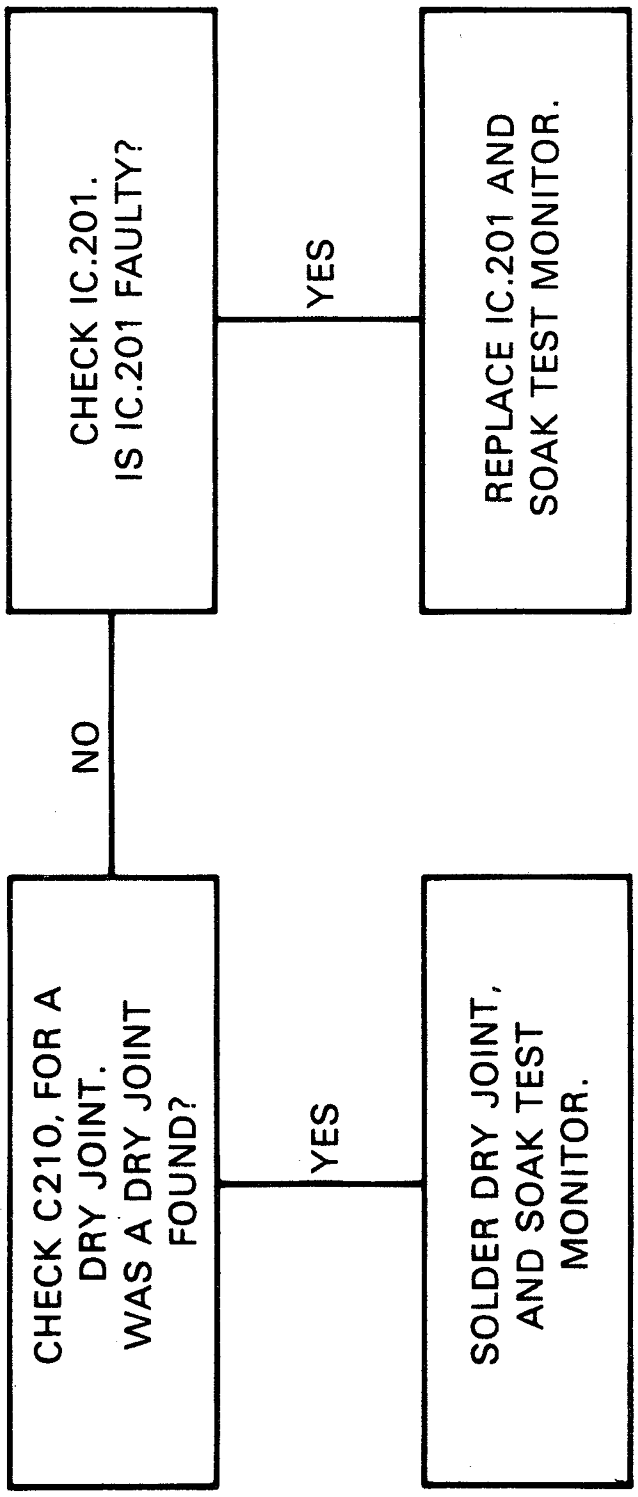
▭ DENOTES TEST VOLTAGE MEASURING POINT

SERIES 3 DRIVE/DEFLECTION PCB - TRACK (SOLDER) SIDE VIEWED THROUGH PCB FROM COMPONENT SIDE

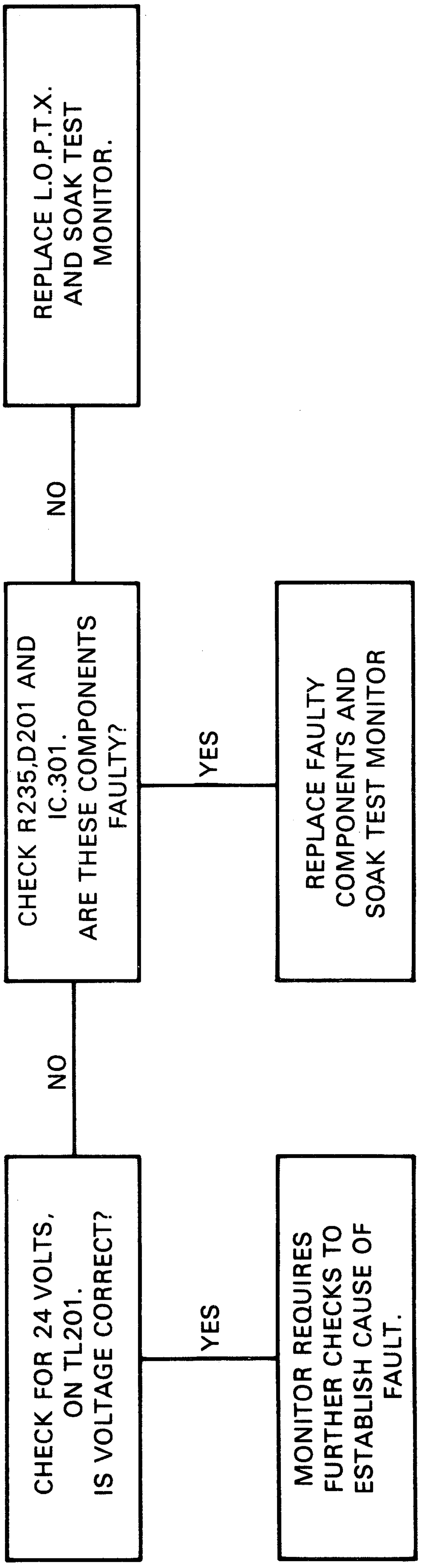
FAULT ISOLATION
CHARTS

FAULT ISOLATION CHARTS

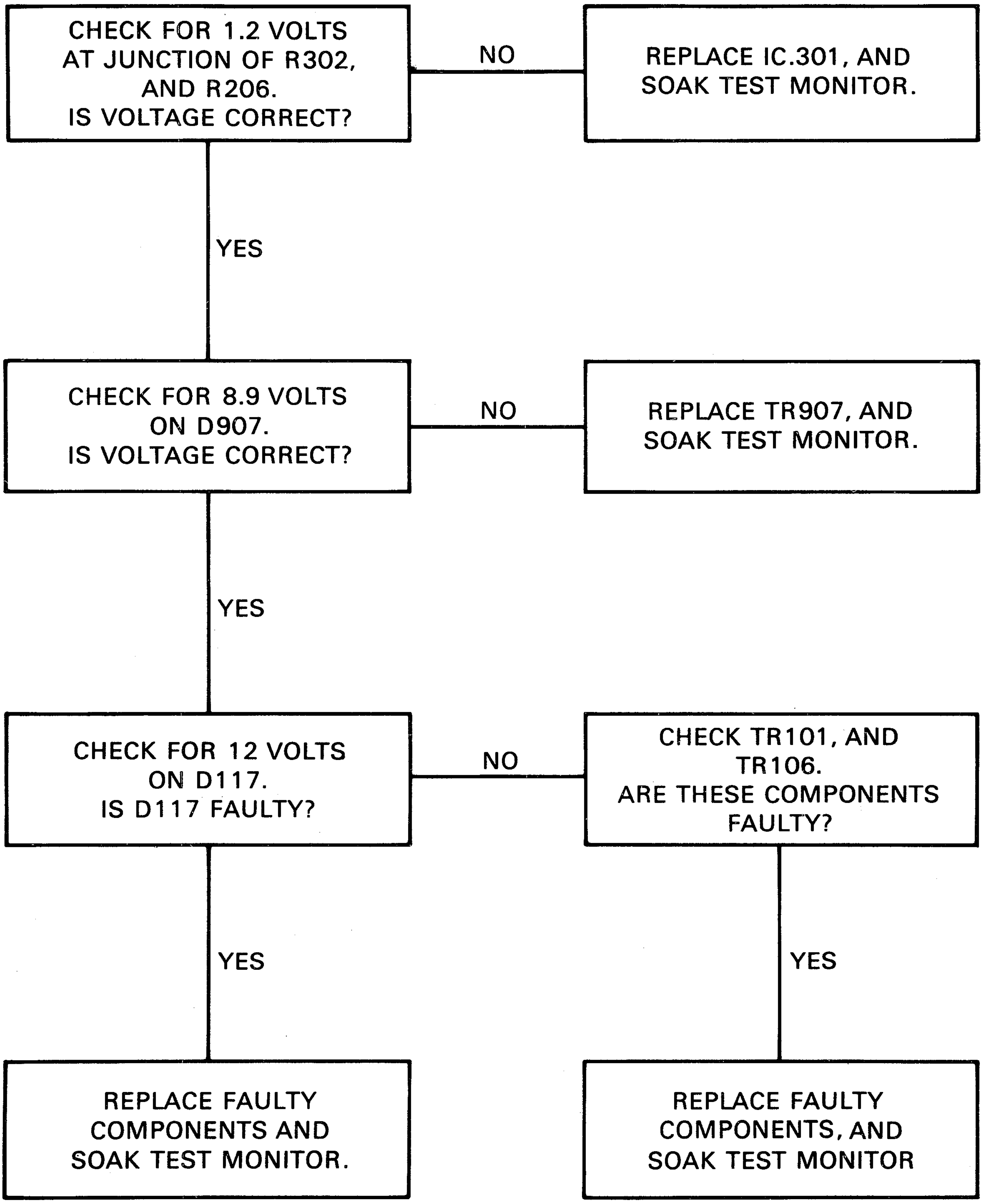
INTERMITTENT –
LINE SYNC


CHECK C210, FOR A DRY JOINT. WAS A DRY JOINT FOUND?
YES
SOLDER DRY JOINT, AND SOAK TEST MONITOR.
NO
CHECK IC.201. IS IC.201 FAULTY?
YES
REPLACE IC.201 AND SOAK TEST MONITOR.

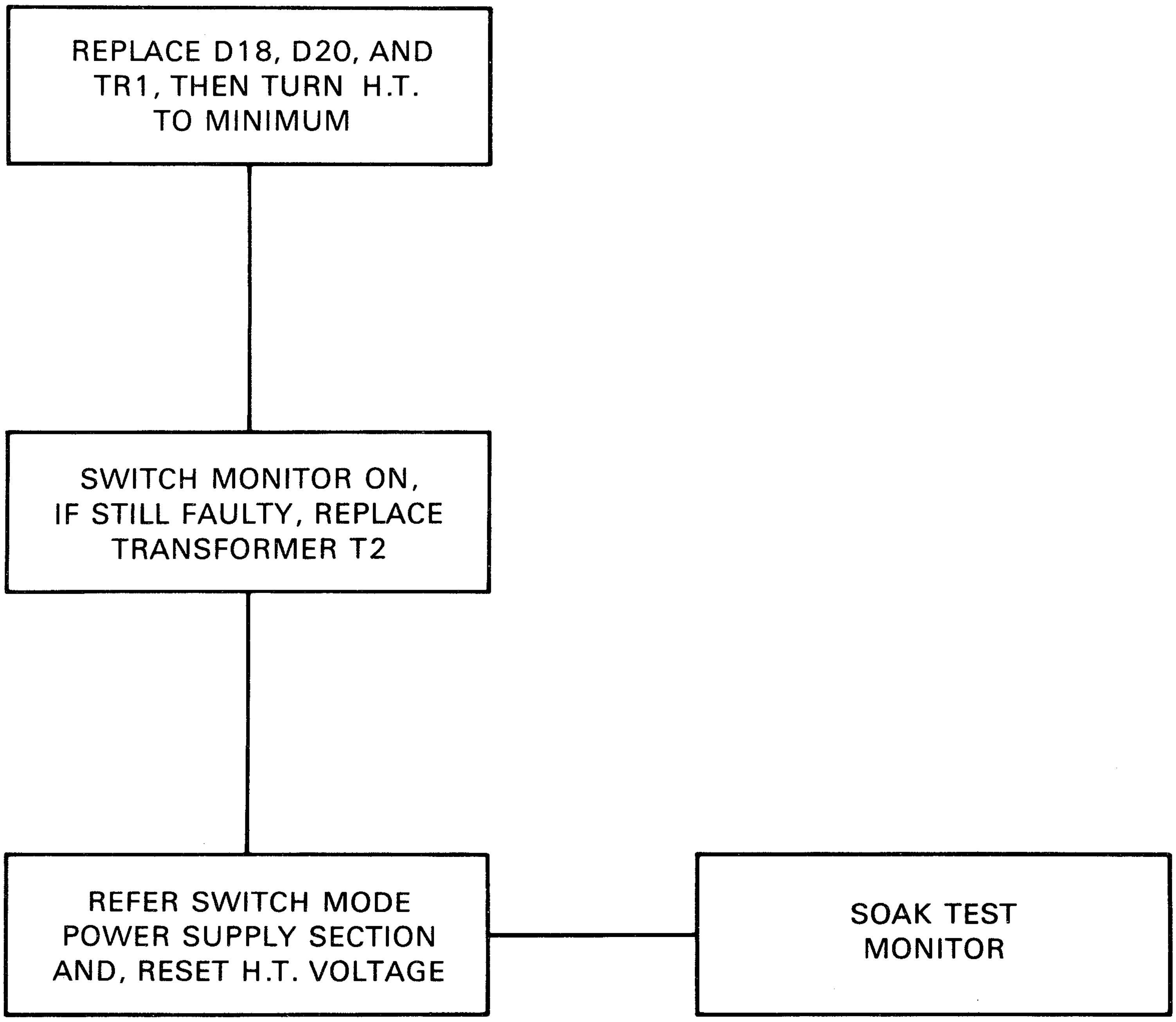
FRAME COLLAPSE

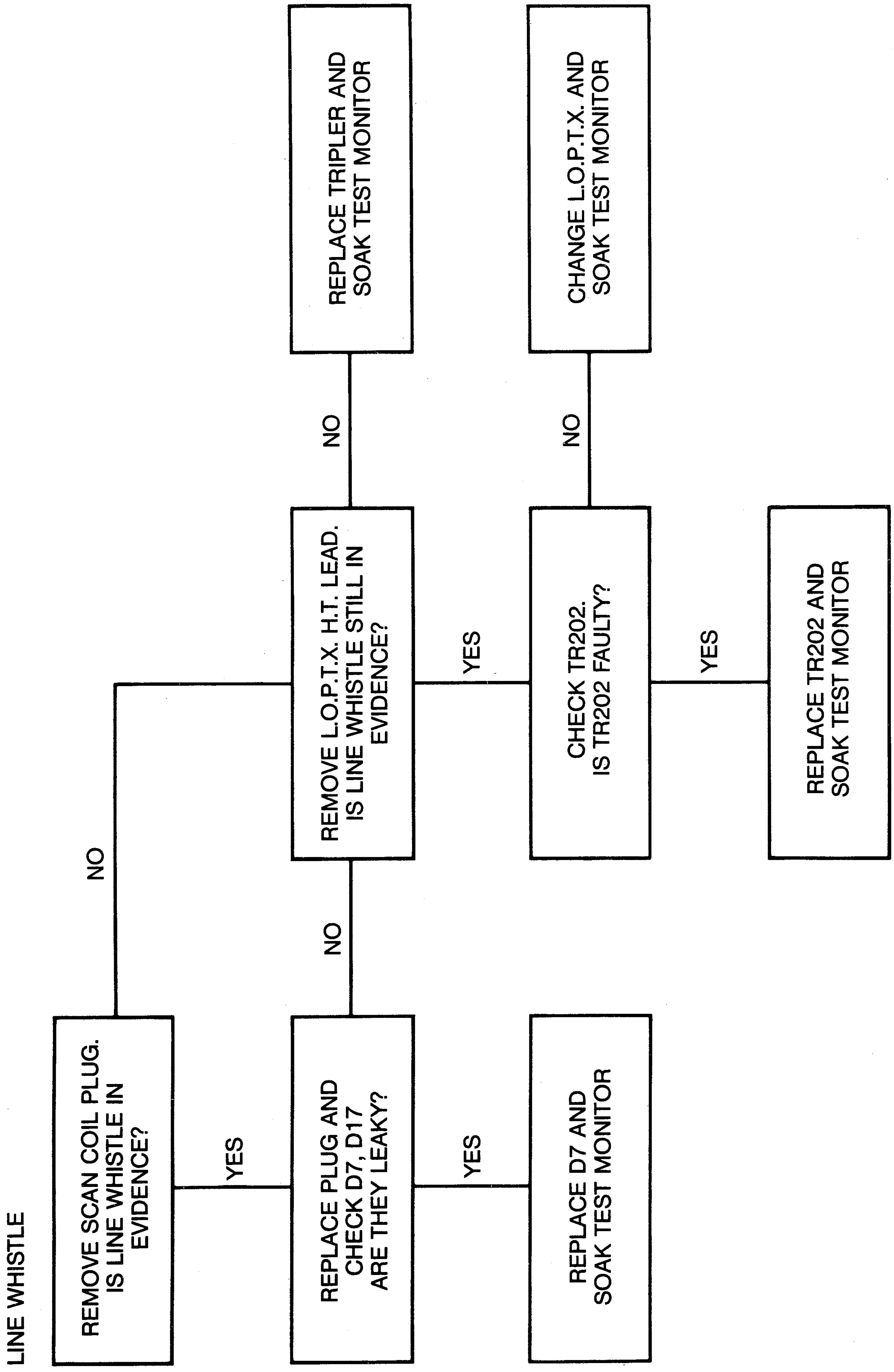

CHECK FOR 24 VOLTS, ON TL201. IS VOLTAGE CORRECT?
YES
MONITOR REQUIRES FURTHER CHECKS TO ESTABLISH CAUSE OF FAULT.
NO
CHECK R235,D201 AND IC.301. ARE THESE COMPONENTS FAULTY?
YES
REPLACE FAULTY COMPONENTS AND SOAK TEST MONITOR
NO
REPLACE L.O.P.T.X. AND SOAK TEST MONITOR.

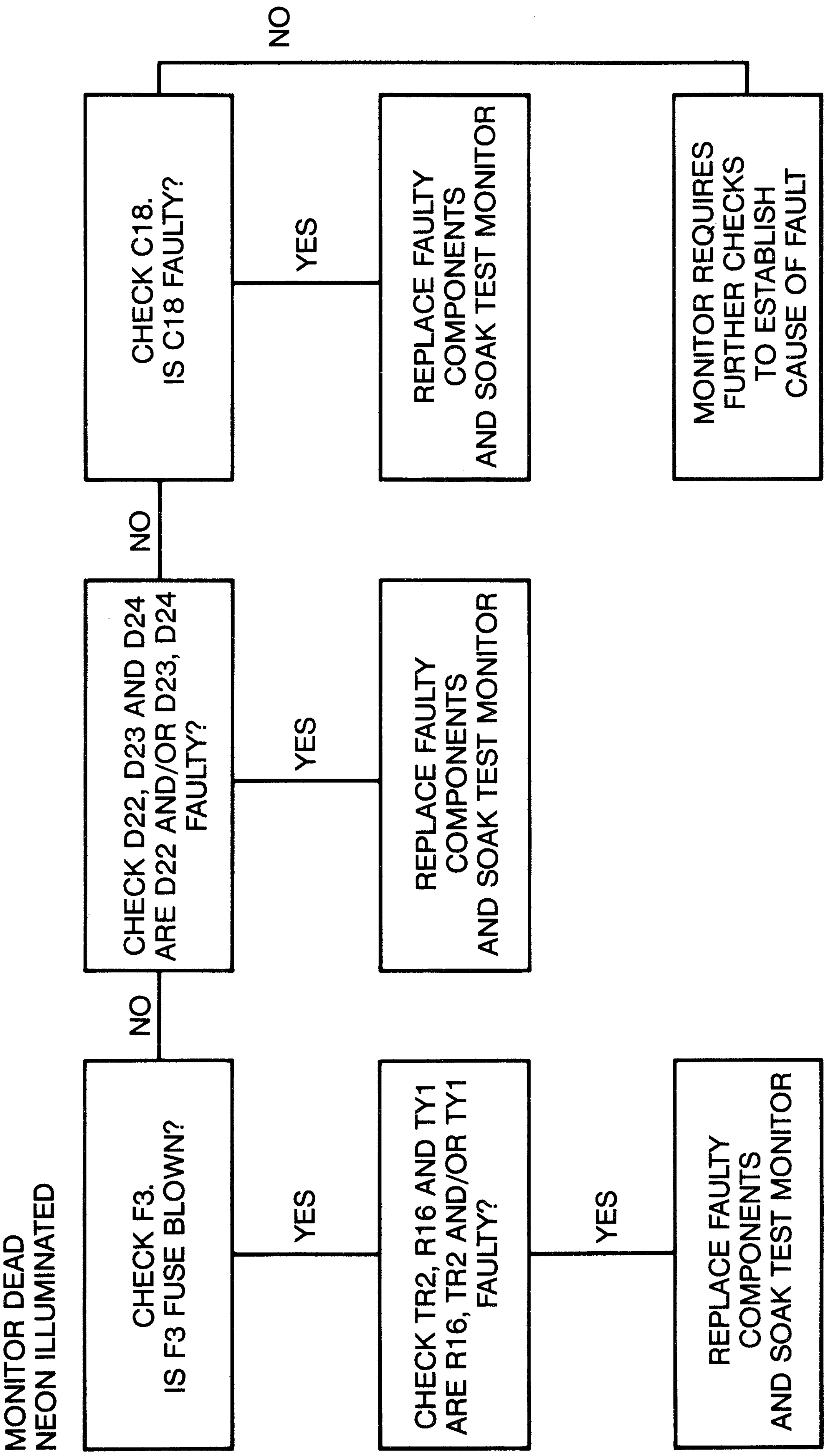
NO PICTURE –
LINE OSCILATING

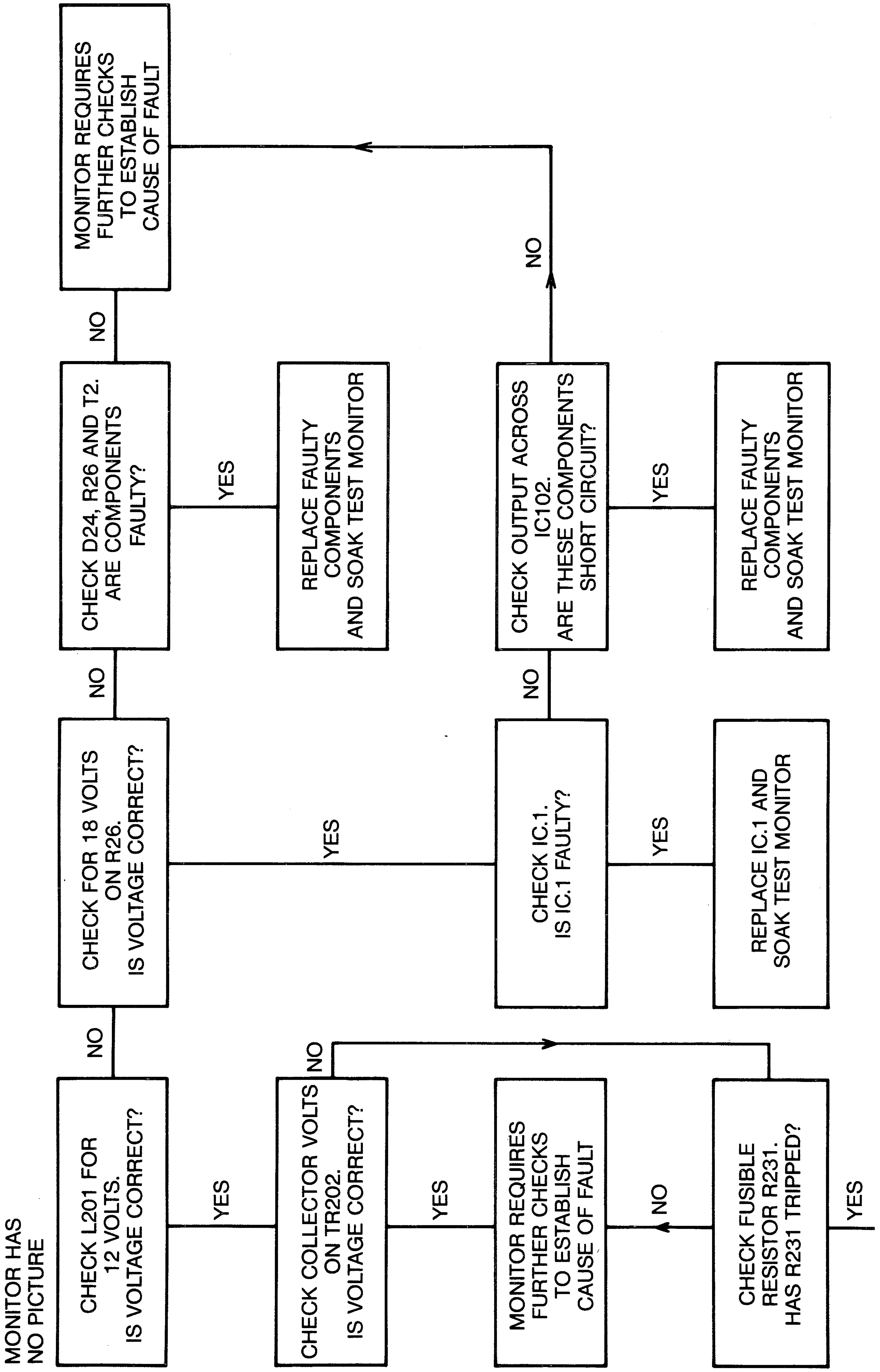

CHECK FOR 1.2 VOLTS AT JUNCTION OF R302, AND R206. IS VOLTAGE CORRECT?
NO
REPLACE IC.301, AND SOAK TEST MONITOR.
YES
CHECK FOR 8.9 VOLTS ON D907. IS VOLTAGE CORRECT?
NO
REPLACE TR907, AND SOAK TEST MONITOR.
YES
CHECK FOR 12 VOLTS ON D117. IS D117 FAULTY?
NO
CHECK TR101, AND TR106. ARE THESE COMPONENTS FAULTY?
YES
YES
REPLACE FAULTY COMPONENTS AND SOAK TEST MONITOR.
REPLACE FAULTY COMPONENTS, AND SOAK TEST MONITOR

BURST MODE

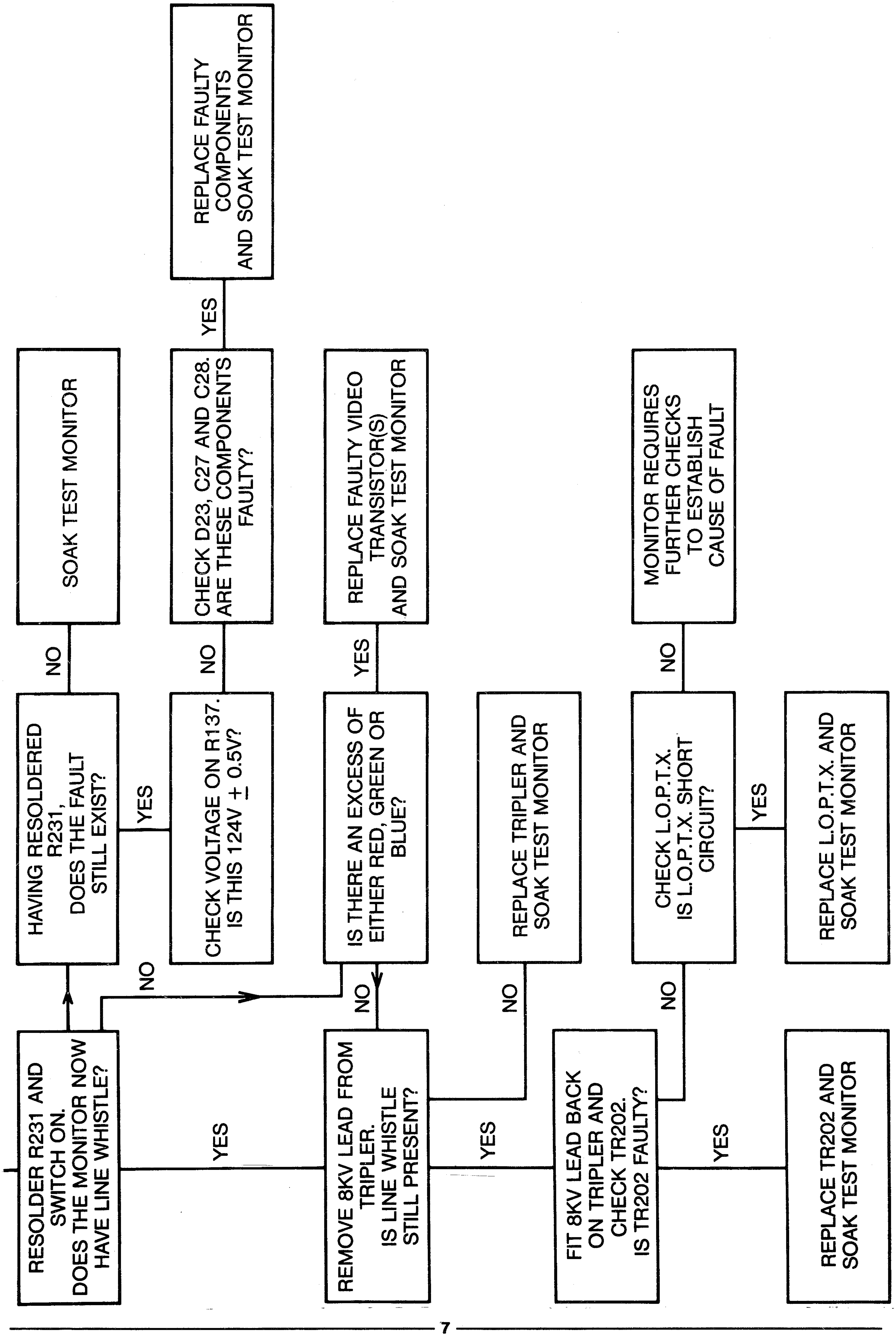

REPLACE D18, D20, AND TR1, THEN TURN H.T. TO MINIMUM
SWITCH MONITOR ON, IF STILL FAULTY, REPLACE TRANSFORMER T2
REFER SWITCH MODE POWER SUPPLY SECTION AND, RESET H.T. VOLTAGE
SOAK TEST MONITOR


LINE WHISTLE
REMOVE SCAN COIL PLUG. IS LINE WHISTLE IN EVIDENCE?
YES
NO
REPLACE PLUG AND CHECK D7, D17 ARE THEY LEAKY?
YES
REPLACE D7 AND SOAK TEST MONITOR
NO
REMOVE L.O.P.T.X. H.T. LEAD. IS LINE WHISTLE STILL IN EVIDENCE?
YES
NO
REPLACE TRIPLER AND SOAK TEST MONITOR
CHECK TR202. IS TR202 FAULTY?
YES
REPLACE TR202 AND SOAK TEST MONITOR
NO
CHANGE L.O.P.T.X. AND SOAK TEST MONITOR

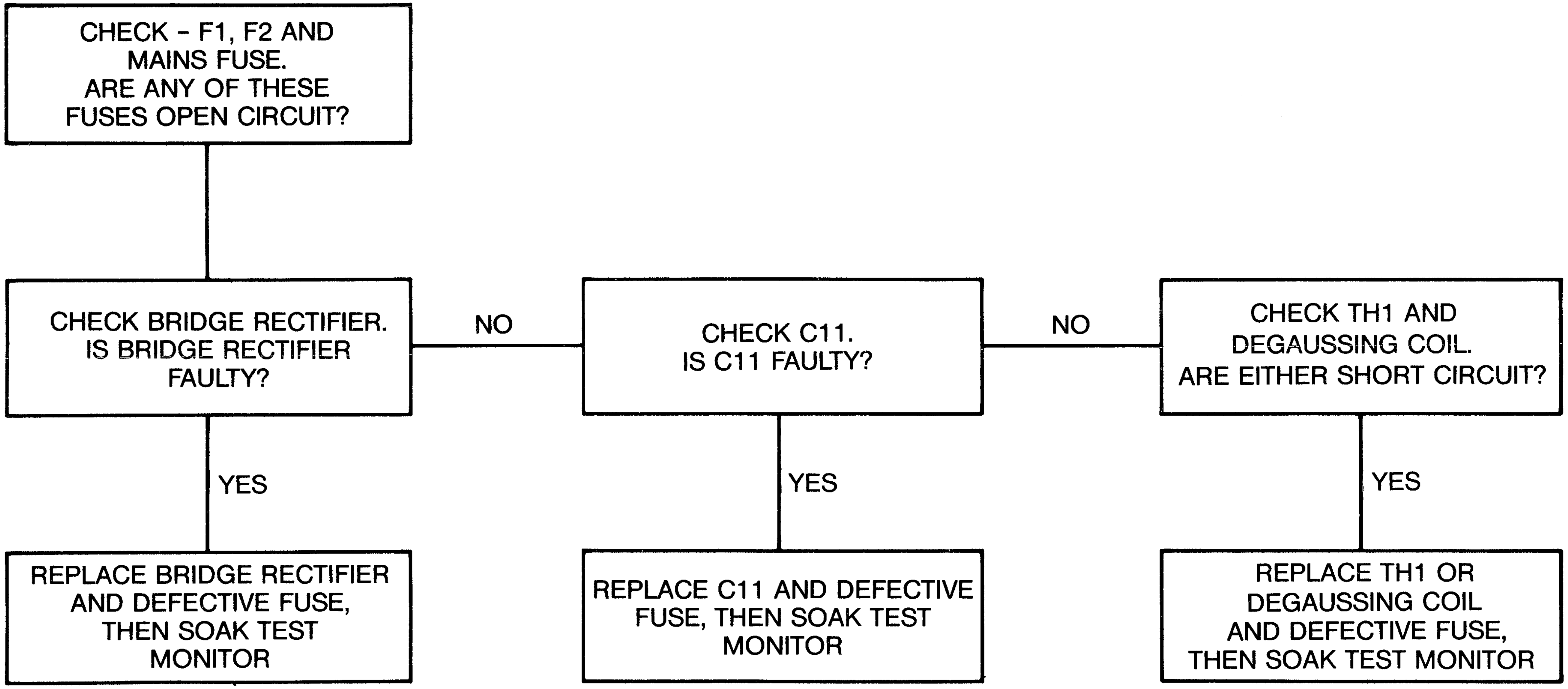

MONITOR DEAD
NEON ILLUMINATED
CHECK F3.
IS F3 FUSE BLOWN?
YES
CHECK TR2, R16 AND TY1
ARE R16, TR2 AND/OR TY1
FAULTY?
YES
REPLACE FAULTY
COMPONENTS
AND SOAK TEST MONITOR
NO
CHECK D22, D23 AND D24
ARE D22 AND/OR D23, D24
FAULTY?
YES
REPLACE FAULTY
COMPONENTS
AND SOAK TEST MONITOR
NO
CHECK C18.
IS C18 FAULTY?
YES
REPLACE FAULTY
COMPONENTS
AND SOAK TEST MONITOR
NO
MONITOR REQUIRES
FURTHER CHECKS
TO ESTABLISH
CAUSE OF FAULT


MONITOR HAS NO PICTURE
CHECK L201 FOR 12 VOLTS. IS VOLTAGE CORRECT?
NO
YES
CHECK FOR 18 VOLTS ON R26. IS VOLTAGE CORRECT?
NO
YES
CHECK D24, R26 AND T2. ARE COMPONENTS FAULTY?
NO
YES
MONITOR REQUIRES FURTHER CHECKS TO ESTABLISH CAUSE OF FAULT
REPLACE FAULTY COMPONENTS AND SOAK TEST MONITOR
CHECK COLLECTOR VOLTS ON TR202. IS VOLTAGE CORRECT?
NO
YES
CHECK IC.1. IS IC.1 FAULTY?
NO
YES
CHECK OUTPUT ACROSS IC102. ARE THESE COMPONENTS SHORT CIRCUIT?
NO
YES
REPLACE FAULTY COMPONENTS AND SOAK TEST MONITOR
REPLACE IC.1 AND SOAK TEST MONITOR
MONITOR REQUIRES FURTHER CHECKS TO ESTABLISH CAUSE OF FAULT
NO
CHECK FUSIBLE RESISTOR R231. HAS R231 TRIPPED?
YES

FAULT ISOLATION CHARTS


RESOLDER R231 AND SWITCH ON. DOES THE MONITOR NOW HAVE LINE WHISTLE?
YES
NO
HAVING RESOLDERED R231, DOES THE FAULT STILL EXIST?
NO
SOAK TEST MONITOR
YES
CHECK VOLTAGE ON R137. IS THIS 124V ± 0.5V?
NO
CHECK D23, C27 AND C28. ARE THESE COMPONENTS FAULTY?
YES
REPLACE FAULTY COMPONENTS AND SOAK TEST MONITOR
IS THERE AN EXCESS OF EITHER RED, GREEN OR BLUE?
YES
REPLACE FAULTY VIDEO TRANSISTOR(S) AND SOAK TEST MONITOR
NO
REMOVE 8KV LEAD FROM TRIPLER. IS LINE WHISTLE STILL PRESENT?
NO
REPLACE TRIPLER AND SOAK TEST MONITOR
YES
FIT 8KV LEAD BACK ON TRIPLER AND CHECK TR202. IS TR202 FAULTY?
NO
CHECK L.O.P.T.X. IS L.O.P.T.X. SHORT CIRCUIT?
NO
MONITOR REQUIRES FURTHER CHECKS TO ESTABLISH CAUSE OF FAULT
YES
REPLACE L.O.P.T.X. AND SOAK TEST MONITOR
YES
REPLACE TR202 AND SOAK TEST MONITOR

MONITOR DEAD -
NEON NOT ILLUMINATED



CHECK - F1, F2 AND MAINS FUSE. ARE ANY OF THESE FUSES OPEN CIRCUIT?
CHECK BRIDGE RECTIFIER. IS BRIDGE RECTIFIER FAULTY?
NO
CHECK C11. IS C11 FAULTY?
NO
CHECK TH1 AND DEGAUSSING COIL. ARE EITHER SHORT CIRCUIT?
YES
YES
YES
REPLACE BRIDGE RECTIFIER AND DEFECTIVE FUSE, THEN SOAK TEST MONITOR
REPLACE C11 AND DEFECTIVE FUSE, THEN SOAK TEST MONITOR
REPLACE TH1 OR DEGAUSSING COIL AND DEFECTIVE FUSE, THEN SOAK TEST MONITOR

PARTS LISTING

COMPONENTS PARTS LIST

INTRODUCTION

The Parts Lists are divided into two sections. The first section covers Model 1431/MS4. Earlier models and variants are shown separately in the second section.

When repairing or replacing components on PCB's, refer to the appropriate Parts List for details of the replacement component.

NOTE

Due to the fact that some monitors may have different component values to those listed below, please replace damaged items with components of identical value. If there is any doubt, consult the manufacturer.

COMPONENTS PARTS LIST - SECTION 1

PARTS LISTING SERIES 3, MODEL 1431/MS4

For identification of parts refer to the Drive/Deflection and Tube Base PCB Circuit Diagram for Model 1431/MS4 in the Drive/Deflection PCB Diagrams Section.

MAIN PCB ASSEMBLY AO3402IO1

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R3		RF393DJO	3K9 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR4		RQ103AL2	1K PRESET POT CARB. MIN. H MTG 20% 0.1W AXIAL
R5		RF104DJO	10K CARBON FILM RESISTOR 5% 0.25W AXIAL
R6		RW154VJ6	15K WW RESISTOR 5% 7W RADIAL
R7		RF471DJO	47R CARBON FILM RESISTOR 5% 0.25W AXIAL
R8		RF224GJO	22K CARBON FILM RESISTOR 5% 0.5W AXIAL
R10		RF392DJO	390R CARBON FILM RESISTOR 5% 0.25W AXIAL
R11		RF221DJO	22R CARBON FILM RESISTOR 5% 0.25W AXIAL
R12		RW103XJ5	1K WW RESISTOR 5% 9W RADIAL
R13		RF274DJO	27K CARBON FILM RESISTOR 5% 0.25W AXIAL
R14		RF102DJO	100R CARBON FILM RESISTOR 5% 0.25W AXIAL
R15		RO150LJO	1R5 METAL OXIDE RESISTOR 5% 2W AXIAL
R16		RW103VJ5	1K WW RESISTOR 5% 7W RADIAL
R17		RG336GJO	⚠ 3M3 METAL GLAZE RESISTOR VDE/BS415 APPROVED 5% 0.5W AXIAL
R21		RF392DJO	390R CARBON FILM RESISTOR 5% 0.25W AXIAL
R22		RF682DJO	680R CARBON FILM RESISTOR 5% 0.25W AXIAL
R23		RF473DJO	4K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R24		RF224DJO	22K CARBON FILM RESISTOR 5% 0.25W AXIAL
R25		RO470LJO	4R7 METAL OXIDE RESISTOR 5% 2W AXIAL
R26		RL470GJO	⚠ 4R7 FUSIBLE METAL RESISTOR 5% 0.5W AXIAL
R27		RF125DJO	120K CARBON FILM RESISTOR 5% 0.25W AXIAL
R29		RF185DJO	180K CARBON FILM RESISTOR 5% 0.25W AXIAL
R101		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R102-107		RF152DJO	150R CARBON FILM RESISTOR 5% 0.25W AXIAL
R108		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R110		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR111		KP0025A05	PLUG 5-WAY 20/3445
R112/113		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R114-116		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R117		RF682DJO	680R CARBON FILM RESISTOR 5% 0.25W AXIAL
R118		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R120-123		RF153DJO	1K5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R124		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R125		RF153DJO	1K5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R126		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R127/128		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R130		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R131-133		RF102DJO	100R CARBON FILM RESISTOR 5% 0.25W AXIAL
VR134		RQ103AL2	1K PRESET POT CARBON MIN 20% 0.1W H.MTG
R135/136		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R137		RF105DJO	100K CARBON FILM RESISTOR 5% 0.25W AXIAL
R140		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R201		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R202		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R203		RF686DJO	6M8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R204		RF156DJO	1M5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R205		RF226DJO	2M2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R206		RF394GJO	39K CARBON FILM RESISTOR 5% 0.25W AXIAL
R207		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R208		RF101DJO	10R CARBON FILM RESISTOR 5% 0.25W AXIAL
R210		RF825DJO	820K CARBON FILM RESISTOR 5% 0.25W AXIAL
R211		RF123DJO	1K2 CARBON FILM RESISTOR 5% 0.25W AXIAL

COMPONENTS PARTS LIST - SECTION 1

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R212		RF363DJ0	3K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
R213		RF105DJ0	100K CARBON FILM RESISTOR 5% 0.25W AXIAL
R214		RF225GJ0	220K CARBON FILM RESISTOR 5% 0.25W AXIAL
R215		RF913DJ0	9K1 CARBON FILM RESISTOR 5% 0.25W AXIAL
R216		RF824DJ0	82K CARBON FILM RESISTOR 5% 0.25W AXIAL
R217		RF224DJ0	22K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR218		RQ224AL1	22K PRESET POT CARBON MIN 20% 0.1W V.MTG
VR220		RQ225AL1	220K PRESET POT CARBON MIN 20% 0.1W V.MTG
R221		RF225DJ0	220K CARBON FILM RESISTOR 5% 0.25W AXIAL
R222		RF155DJ0	150K CARBON FILM RESISTOR 5% 0.25W AXIAL
R223/224		RF222DJ0	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R225		RW333LJ5	3K3 WW RESISTOR 5% 2W (PLUG)
R226		RX223PJ0	⚠ 2K2 FUSIBLE WW RESISTOR 5% 2W RADIAL
R227		RO100JJ0	1R0 METAL OXIDE RESISTOR 5% 1W AXIAL
R228-230		RW682PJ0	680R WW RESISTOR 5% 4W AXIAL
R231		RX151SJ6	⚠ 15R FUSIBLE WW RESISTOR 5% 2W8 RADIAL
R232		RO101LJ0	10R METAL OXIDE RESISTOR 5% 2W AXIAL
R233/234		RF394GJ0	39K CARBON FILM RESISTOR 5% 0.5W AXIAL
R235		RL101GJ0	⚠ 10R FUSIBLE METAL RESISTOR 5% 0.5W AXIAL
R236		RM155LJ0	150K M/FILM RESISTOR 5% 2W
R301		RF685DJ0	680K CARBON FILM RESISTOR 5% 0.25W AXIAL
R302		RF124DJ0	12K CARBON FILM RESISTOR 5% 0.25W AXIAL
R303/304		RF475DJ0	470K CARBON FILM RESISTOR 5% 0.25W AXIAL
R305		RF685DJ0	680K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR306		RQ475AL1	470K PRESET POT CARBON MIN 20% 0.1W V.MTG
VR307		RQ105AL1	100K PRESET POT CARBON MIN 20% 0.1W V.MTG
R308		RF155DJ0	150K CARBON FILM RESISTOR 5% 0.25W AXIAL
R310		RF183DJ0	1K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R311		RF563DJ0	5K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR312		RQ105AL1	100K PRESET POT CARBON MIN 20% 0.1W V.MTG
R313/314		RF474DJ0	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R315		RF225DJ0	220K CARBON FILM RESISTOR 5% 0.25W AXIAL
R316		RF184DJ0	18K CARBON FILM RESISTOR 5% 0.25W AXIAL
R317		RF563DJ0	5K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
R318		RF184DJ0	18K CARBON FILM RESISTOR 5% 0.25W AXIAL
R320		RF330DJ0	3R3 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR321		RS103PL2	1K PRESET POT CARB. MIN WW/H.MTG 20% 4W
R322		RF332JJ0	330R CARBON FILM RESISTOR 5% 1W AXIAL
R323		RF100DJ0	1R0 CARBON FILM RESISTOR 5% 0.25W AXIAL
R324		RF103DJ0	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R327		RF331DJ0	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
C1		CX225NL6	⚠ 220nF 250V AC MET POLY CLASS X CAP 20% RADIAL
C2/3		CY103NL6	⚠ 1000pF 250V AC CERAMIC DISC CAPACITOR CLASS Y 20% RADIAL
C4			⚠ 220nF 250V AC MET POLY CLASS X CAP 20% RADIAL
C5		CD472YL6	470pF 2KV CERAMIC CAPACITOR 10% RADIAL
C6		CM104TL6	10nF 630V MET POLY CAPACITOR 20% RADIAL
C7		CD472YL6	470pF 2KV CERAMIC CAPACITOR 10% RADIAL
C8		CM104TL6	10nF 630V MET POLY CAPACITOR 20% RADIAL
C10		RF224GJ0	22K CARBON FILM RESISTOR 5% 0.25W AXIAL
C11		CA108RL7	100µF 400V ALUM ELECT CAPACITOR 20% RADIAL
C11		CA288QM7	220µF 385V ALUM ELECT CAPACITOR - 20+50% RADIAL
C12		CA476JL7	4.7µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C13/14		CM105RK6	0.1µF 400V MET POLY CAPACITOR 10% RADIAL

COMPONENTS PARTS LIST - SECTION 1

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
C15		CD473KK6	4700pF 100V CERAMIC CAPACITOR 20% RADIAL
C16		CR104MK0	10nF 160V POLYSTYRENE CAPACITOR 10% AXIAL
C17		CL223XJ6	⚠ 2200pF 2000V POLYPROPYLENE CAPACITOR 5% RADIAL
C18		CA1068L0	1µF 63V ALUM ELECT CAPACITOR 20% AXIAL
C20		CY103NL6	⚠ 1000pF 250V AC CERAMIC DISC CAPACITOR CLASS Y 20% RADIAL
C22		CC223KK6	2.2µF 100V CERAMIC CAPACITOR 20% RADIAL
C23		CA476JL7	4.7µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C24		CM105NK6	100nF 250V MET POLY CAPACITOR 10% RADIAL
C25		CD472SK7	470pF 500V CERAMIC CAPACITOR 20% RADIAL
C26-28		CA477NM7	47µF 250V ALUM ELECT CAPACITOR - 20+50% RADIAL
C30		CD472SK7	470pF 500V CERAMIC CAPACITOR 20% RADIAL
C31		CA478FM7	470µF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C32/33		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C34		CA228FM7	220µF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C101/102		CA107JL7	10µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C103/104		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C105		CA107JL7	10µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C106		CM225KK6	0.22µF 100V MET POLY CAPACITOR 20% RADIAL
C201/202		CD102KK6	100pF 100V CERAMIC CAPACITOR 10% RADIAL
C203		CM475KL6	470nF 100V MET POLY CAPACITOR 20% RADIAL
C204		CM225KK6	0.22µF 100V MET POLY CAPACITOR 20% RADIAL
C205		CM105NK6	100nF 250V MET POLY CAPACITOR 10% RADIAL
C206		CA1068L0	1µF 63V ALUM ELECT CAPACITOR 20% AXIAL
C207		CA476JL7	4.7µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C208		CM104TL6	10nF 630V MET POLY CAPACITOR 20% RADIAL
C210		CJ473JJ0	4700pF 50V POLYSTYRENE CAPACITOR 5% AXIAL
C211		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C212		CA228FM7	220µF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C213		CM474NK6	47nF 250V MET POLY CAPACITOR 20% RADIAL
C214/215		CM105NK6	100nF 250V MET POLY CAPACITOR 10% RADIAL
C216/217		CD104YP7	10nF 2KV CERAMIC CAPACITOR - 20+80% RADIAL
C218		CL335NK6	⚠0.33µF 250V POLYPROPYLENE CAP 10% RADIAL
C220		CM104TL6	10µF 630V MET POLY CAPACITOR 20% RADIAL
C221		CM475RL6	470nF 400V MET POLY CAPACITOR 20% RADIAL
C222		CL753XJ6	⚠7500pF 1500V POLYPROPYLENE CAP 5% RADIAL
C223		CL684XK6	68nF 1500V POLY CAPACITOR 20% RADIAL
C224		CA109JL7	1000µF 50V ALUM ELECT CAPACITOR 20% RADIAL
C301		CM225KK6	0.22µF 100V MET POLY CAPACITOR 20% RADIAL
C302		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C303		CM155KK6	150nF 100V MET POLY CAPACITOR 20% RADIAL
C304		CA108HL7	100µF 35V ALUM ELECT CAPACITOR 20% RADIAL
C305/306		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C307		CD122SL6	120pF 500V CERAMIC CAPACITOR 10% RADIAL
C308		CA107JL7	10µF 50V ALUM ELECT CAP 20% RADIAL
C310		CM105NK6	100nF 250V POLY CAPACITOR 10% RADIAL
C311		CA478HM7	470µF 35V ALUM ELECT CAP - 20+50% RADIAL
D1-4		DP4007UU0	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL
D5		WL6300TU1	ZEROHM SHORT CIRCUIT LINK
D6		DF0157UU0	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D7		DF0096UU0	FAST RECOVERY DIODE BYV96E MOTOROLA AXIAL
D8, 10-14		DS4148UU0	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D15/16		DP4007UU0	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL

COMPONENTS PARTS LIST - SECTION 1

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
D17		DF0159UU0	FAST RECOVERY DIODE BA159 MOTOROLA AXIAL
D18		DZ88750FB0	ZENER DIODE BZY88B7V5 400mW 2% AXIAL
D20		DZ79331FB0	ZENER DIODE BZX79B33V 400m W 2% AXIAL
D21		DP4007UU0	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL
D22		DF0159UU0	FAST RECOVERY DIODE BA159 MOTOROLA AXIAL
D23		DF0096UU0	FAST RECOVERY DIODE BYV96E MOTOROLA AXIAL
D24		DF0157UU0	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D25, 116		DP4007UU0	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL
D101-107		DS4148UU0	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D108, 110, 111		DZ79560EB0	ZENER DIODE BZX79B5V6 400mW 2% AXIAL
D117		DZ79121FB0	ZENER DIODE BZX79B12V 400mW 2% AXIAL
D118		DZ79560FB0	ZENER DIODE BZX79B5V6 400mW 2% AXIAL
D201		DF0157UU0	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D301		DS4148UU0	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D302		DP4007UU0	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL
F1/F2 T 2A, F3 1A		KS0003Y01	FUSEHOLDER L222/K
HARNESS		WA0021A03	TB - NO. 1 (4 LEADS) BR, OR, W,Y.
HARNESS		WA0020A03	TB - NO. 2 (8 LEADS)
IC1		IV7812MX3	VOLTAGE REGULATOR 1C 78M12
HEATSINK		A00136I01	HEATSINK (LCCD) ASSEMBLY
IC1 (HEATSINK)		HH0003HA0	HEATSINK 1 STAVER TYPE V6-2L
IC101		IT74136MU2	OR/TTL LOGIC SN74LS136N
IC102		IV7805LU0	VOLTAGE REGULATOR IC "!" 78L05
IC201		IL1180PU2	LINEAR BI-POLAR IC TDA 1180P PLASTIC DIL S.G.S.
IC301		IL1170SU2	LINEAR BI-POLAR IC TDA 1170S PLASTIC DIL S.G.S.
IC301 (HEATSINK)		HH0001HC0	HEATSINK STAVER V8-800
L2		LW104UA7	CHOKE WIRE ENDED 10μH PC5640
L201		LW154SK2	CHOKE WIRE ENDED 15μH B78108-T1153-K
L202		LV001UA5	COIL WIDTH PC3398
L203		LN002UA6	COIL LINE LINEARITY PC5580
L204		LW104UA7	CHOKE WIRE ENDED 10μH PC5640
LK1-17		WL6300TU1	ZEROHM SHORT CIRCUIT LINK
LK23		WL2214TU1	WIRE LINK 5mm x 14mm x 5mm
PL1		KP0300D06	6-PIN INCLINE PLUG PCB MTG SHROUDED LOCKABLE, PRESSAC 320/3766
PL2		KP0025A03	PLUG 3-WAY 20/3443
PL3		KP0300D05	5 2-PIN INLINE PLUG MTG SHROUDED LOCKABLE, PRESSAC 320/3765
PL101		KP0026AI0	10-PIN INLINE PLUG PCB MTG SHROUDED PRESSAC 20/3450
PL103		KP0025AI0	10-PIN INLINE PLUG PCB MTG UNSHROUDED PRESSAC 20/3430
PL201		KP0300D08	8-PIN INLINE PLUG PCB MTG UNSHROUDED LOCKABLE, PRESSAC 320/3768
T1A/1B		LM0001UA1	CHOKE (OREGA) 88545-00
T2		TI0004I06	TRANSFORMER SWITCH MODE ISOLATING PC5287 OR PC5307
T201		TI0009I01	TRANSFORMER LINE DRIVER PC4163
T203		TI10007I01	⚠TRANSFORMER LINE OUTPUT 14" PC3755
TH1		RT005QN0	THERMISTOR 263100P2332T333
TH2		RT003NN0	THERMISTOR 15 OHMS 30% K231
TL101		KP0024A03	3-WAY PLUG 20/3423
TL102A/B		KM3070Y01	PIN TEST 10/3070 PRESSAC
TL106		KP0024A03	3-WAY PLUG 20/3423
TL201A/B		KM3070Y01	PIN TEST 10/3070 PRESSAC

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TL202-2		WL2210TU1	WIRE LINK 5mm x 14mm x 5mm
TR1		QS0307UU5	PNP SILICON TRANSISTOR BC307-5 MOTOROLA
TR2		QP0753UX0	NPN TRANSISTOR TIPL 753A (R3213)
HEATSINK		A00007I03	HEATSINK (SMPSU) ASSEMBLY
TR2		M00205I02	HEATSINK RED POINT TV92
HEATSINK		A00008I02	HEATSINK (LOPT) ASSEMBLY
TR101		QS0337UT0	NPN SILICON TRANSISTOR BC 337-5 MOTOROLA
TR102		QS4123UU0	NPN SILICON TRANSISTOR 2N4123 MOTOROLA
TR103-105		QS4125UU5	PNP SILICON TRANSISTOR 2N4125 MOTOROLA
TR106		QS0337UT0	NPN SILICON TRANSISTOR BC337-5 MOTOROLA
TR201		QS0001UU0	NPN SILICON TRANSISTOR BF819A, BF858A, BF859A
TR202		QS0208UU0	NPN SILICON POWER TRANSISTOR BU208A
TR202 HEATSINK		M00205I02	HEATSINK RED POINT TV-92
TY1		QY0102UU0	THYRISTOR 30-100V 0.8A FAST
TY2 FIT REVERSED		QY0102DC0	THYRISTOR X0102DA
PCB		BC0029I11	MAIN PCB ASSEMBLY SERIES 3
CHAS GND		KM0006YO1	PIN TURRET 10/006 PRESSAC
AV LINK		KM3070YO1	PIN TEST 10/3070 PRESSAC

COMPONENTS PARTS LIST - SECTION 1

TUBE BASE ASSEMBLY AO3092IO1

COMP. REF.	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R901		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R902		RF223DJO	2K2 PRESET POT CARB MIN H MTG 20% 0.1W AXIAL
VR903		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R904		RO154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R905		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR906		RQ223AL2	2K2 PRESET POT CARB MIN H MTG 20% 0.1W
R907		RL102DJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R908		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR910		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R911		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R912		RO154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R913		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR914		RO223AL2	2K2 PRESET POT CARB MIN H MTG 20% 0.1W
R915		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR916		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R917		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R918		RO154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R920		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR921		RQ223AL2	2K2 PRESET POT CARB MIN H MTG 20% 0.1W
R922		RL102DJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R923		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R924-926		RK222GKO	220R CARBON COMP RESISTOR 10% 0.5W AXIAL
R927		RK105GKO	100K CARBON COMP RESISTOR 10% 0.5W AXIAL
R928		RF475DJO	470K CARBON FILM RESISTOR 5% 0.25W AXIAL
R931		RK825GKO	820K CARBON COMP RESISTOR 10% 0.5W AXIAL
VR932		RQ226DL2	2M2 PRESET POT CARBON H MTG 20% 0.25W
R933		RF155LJO	150K M/FILM RESISTOR 5% 2W AXIAL
R934		RF225LJO	220K M/FILM RESISTOR 5% 2W AXIAL
R935		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R936		RL102DJO	⚠ 100R FUSIBLE METAL RESISTOR 5% 0.25W AXIAL
R937		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
C901		CM105NK6	100nF 250V METAL POLYESTER CAPACITOR 10% RADIAL
C902,904,906		CK271JJO	27pF 50V CERAMIC CAPACITOR
C903,905,907		CK122JJO	120pF CERAMIC CAPACITOR 5%
C910/911		CD104YP7	10nF 2KV CERAMIC CAPACITOR - 20+80% RADIAL
C911ADJ		KM0006YO1	PIN TURRET 10/006 PRESSAC
C913		CM105NK6	100nF METAL POLYESTER CAPACITOR 10% RADIAL
D901-906, D908		DS4148UUO	SMALL SIGNAL DIODE IN4148
D907		DZ88750FBO	DIODE BZY88B7V5
L901			
L924-926		LW154SK2	CHOKE 15µH B78108-T1153-K
TL901		KM3070YO1	PIN TEST 10/3070 PRESSAC
TL901		KL4838ZO2	TEST LINK 10/4838 PRESSAC
TR901,903,905		QS0042UUO	NPN SILICON TRANSISTOR MPSA42
TR902,904,906		QS0869UAO	NPN SILICON TRANSISTOR BF869
TR907		QS4123UUO	NPN SILICON TRANSISTOR 2N4123
PCB		BC0008IO7	TUBE BASE STD & MED RESOLUTION

COMPONENTS PARTS LIST - SECTION 2

PARTS LISTING SERIES 3, EARLIER MODELS AND VARIANTS

For identification of parts refer to the diagrams at the end of this section.

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R1		RK105GKO	100K CARBON COMP. RESISTOR 10% 0.5W AXIAL
R2		RF185JJO	180K CARBON FILM RESISTOR 5% 1W AXIAL
R3		RF393DJO	3K9 CARBON FILM RESISTOR 5% 0.25W AXIAL
R3	(1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1449/AS)	RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R3	(1496/LI2U) (1486/LI2U)	RF363DJO	3K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
R3	(1241/AS) (1446/LI2) (1451/MQ3)	RF473DJO	4K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R3	(1446/LF)	RF333DJO	3K3 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR4		RQ103AL2	1K PRESET POT CARB. MIN. H MTG 20% 0.1W AXIAL
R5		RF104DJO	10K CARBON FILM RESISTOR 5% 0.25W AXIAL
R5	(1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1449/AS)	RF683DJO	6K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R5	(1486/LI2U)	RF823DJO	8K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R6		RW154XJ6	15K WW RESISTOR 5% 7W RADIAL
R7		RF471DJO	47R CARBON FILM RESISTOR 5% 0.25W AXIAL
R8		RF333JJO	3K3 CARBON FILM RESISTOR 5% 1W AXIAL
R8	(1496/LI2U) (1486/LI2U)	RF224GJO	22K CARBON FILM RESISTOR 5% 0.5W AXIAL
R8	(1451/AS)	RF564GJO	56K CARBON FILM RESISTOR 5% 0.5W AXIAL
R10		RF392DJO	390R CARBON FILM RESISTOR 5% 0.25W AXIAL
R11		RF221DJO	22R CARBON FILM RESISTOR 5% 0.25W AXIAL
R12		RW103XJ5	1K WW RESISTOR 5% 9W RADIAL
R12	(1451AP/DS) (1451/DS)	RW103VJ5	1K WW RESISTOR 5% 7W RADIAL
R13		RF274DJO	27K CARBON FILM RESISTOR 5% 0.25W AXIAL
R14		RF102DJO	100R CARBON FILM RESISTOR 5% 0.25W AXIAL
R15		R0150LJO	1R5 METAL OXIDE RESISTOR 5% 2W AXIAL
R16		RW472ZJ5	470R RESISTOR 5% 11W RADIAL
R16	(1496/LI2U) (1486/LI2U)	RW103XJ5	1K WW RESISTOR 5% 9W RADIAL
R16	(1451/AS)	RW333RJO	3K3 WW RESISTOR 5% 5W RADIAL
R16	(1451AP/DS) (1431/DS) (1451/DS)	RW103VJ5	1K WW RESISTOR 5% 7W RADIAL
R17		RG336GJO	⚠ 3M3 METAL GLAZE RESISTOR VDE/BS415 APPROVED 5% 0.5W AXIAL
R18/20		RF394GJO	39K CARBON FILM RESISTOR 5% 0.5 AXIAL
R21		RF392DJO	390R CARBON FILM RESISTOR 5% 0.25W AXIAL
R22		RF682DJO	680R CARBON FILM RESISTOR 5% 0.25W AXIAL
R23		RF104DJO	10K CARBON FILM RESISTOR 5% 0.25W AXIAL
R23	(1441/AL)	RF683DJO	6K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R24		RF224DJO	22K CARBON FILM RESISTOR 5% 0.25W AXIAL
R25		R0470LJO	4R7 METAL OXIDE RESISTOR 5% 2W AXIAL
R26		RL470GJO	⚠ 4R7 FUSIBLE METAL RESISTOR 5% 0.5W AXIAL
R27		RF125DJO	120K CARBON FILM RESISTOR 5% 0.25W AXIAL
R29		RF185DJO	180K CARBON FILM RESISTOR 5% 0.25W AXIAL
R29	(1486/LI2U)	RF684DJO	68K CARBON FILM RESISTOR 5% 0.25W AXIAL
R30		WL2214TU1	LINK 5mm x 14mm x 5mm

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R32	(1431AP/MS) (1431AP/DS) (1451AP/DS) (2040/CS5)	RF392DJO	390R CARBON FILM RESISTOR 5% 0.25W AXIAL
R101		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R102-107		RF152DJO	150R CARBON FILM RESISTOR 5% 0.25W AXIAL
R108		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R110		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR111		KP0025A05	PLUG 5-WAY 20/3445
VR111	(1451/AS) (1441/AS) (1241/AS)	RQ104CL1	10K PRESET POT CARB MIN 20% 0.15W V.MTG
VR111	(1439/AS) (1431AP/MS4) (1431AP/DS) (1435/MS) (1439/MS)	KP0026A08	PLUG 8-WAY PRESSAC 2S/20/3448/BDFH
R112/113		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R114-116		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R117		RF682DJO	680R CARBON FILM RESISTOR 5% 0.25W AXIAL
R118		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R120-123		RF153DJO	1K5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R124		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R125		RF153DJO	1K5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R126		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R127/128		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R130		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R131-133		RF102DJO	100R CARBON FILM RESISTOR 5% 0.25W AXIAL
VR134		RQ103AL2	1K PRESET POT CARBON MIN 20% 0.1W H.MTG
R135/R136		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R137		RF185DJO	180K CARBON FILM RESISTOR 5% 0.25W AXIAL
R138		RF105DJO	100K CARBON FILM RESISTOR 5% 0.25W AXIAL
R138	(1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1496/LI2U) (1486/LI2U) (1451/AS) (1451/MS) (1451/DS) (1451AP/MS4) (1451AP/DS) (1449/AS) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	RF185DJO	180K CARBON FILM RESISTOR 5% 0.25W AXIAL
R140		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R201		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R202		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R203		RF686DJO	6M8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R204		RF156DJO	1M5 CARBON FILM RESISTOR 5% 0.25W AXIAL
R205		RF226DJO	2M2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R206		RF394GJO	39K CARBON FILM RESISTOR 5% 0.25W AXIAL
R207		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R208		RF101DJO	10R CARBON FILM RESISTOR 5% 0.25W AXIAL

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R210		RF825DJO	820K CARBON FILM RESISTOR 5% 0.25W AXIAL
R211		RF123DJO	1K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R212		RF363DJO	3K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
R213		RF105DJO	100K CARBON FILM RESISTOR 5% 0.25W AXIAL
R214		RF225GJO	220K CARBON FILM RESISTOR 5% 0.5W AXIAL
R215		RF104DJO	10K CARBON FILM RESISTOR 5% 0.25W AXIAL
R215	(1441/AL)	RF913DJO	9K1 CARBON FILM RESISTOR 5% 0.25W AXIAL
R216		RF824DJO	82K CARBON FILM RESISTOR 5% 0.25W AXIAL
R217		RF224DJO	22K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR218		RQ224AL1	22K PRESET POT CARBON MIN 20% 0.1W V.MTG
VR220		RQ225AL1	220K PRESET POT CARBON MIN 20% 0.1W V.MTG
R221		RF225DJO	220K CARBON FILM RESISTOR 5% 0.25W AXIAL
R222		RF155DJO	150K CARBON FILM RESISTOR 5% 0.25W AXIAL
R223/224		RF222DJO	220R CARBON FILM RESISTOR 5% 0.25W AXIAL
R225		RW333LJ5	3K3 WW RESISTOR 5% 2W (PLUG)
R226		RX223PJO	⚠ 2K2 FUSIBLE WW RESISTOR 5% 2W RADIAL
R227		RF100JJO	1RO CARBON FILM RESISTOR 5% 1W AXIAL
R227	(1496/LI2U) (1431/DS) (1439/AS) (1439/MS) (2030/CS5) (2031/CS5) (2031/AX) (2032/AM) (1486/LI2U) (1451/MS) (1451/DS) (1456/LI2) (1241/AS) (1241/AT)	R0100JJO	1RO METAL OXIDE RESISTOR 5% 1W AXIAL
R228/230		RW682PJO	680R WW RESISTOR 5% 4W AXIAL
R231		RX1518J6	⚠ 15R FUSIBLE WW RESISTOR 5% 2W8 RADIAL
R232		R0101LJO	10R METAL OXIDE RESISTOR 5% 2W AXIAL
R233/234		RF394GJO	39K CARBON FILM RESISTOR 5% 0.5W AXIAL
R235		RL101GJO	⚠ 10R FUSIBLE METAL RESISTOR 5% 0.5W AXIAL
R236		RF155JJO	150K CARBON FILM RESISTOR 5% 1W AXIAL
R237	(2030/CS5) (2031/CS5) (2031/AX) (2032/AM)	RW220PJO	2R2 WW RESISTOR 5% 4W AXIAL
R301		RF685DJO	680K CARBON FILM RESISTOR 5% 0.25W AXIAL
R302		RF124DJO	12K CARBON FILM RESISTOR 5% 0.25W AXIAL
R303/304		RF475DJO	470K CARBON FILM RESISTOR 5% 0.25W AXIAL
R305		RF685DJO	680K CARBON FILM RESISTOR 5% 0.25W AXIAL
VR306		RQ475AL1	470K PRESET POT CARBON MIN 20% 0.1W V.MTG
VR307		RQ105AL1	100K PRESET POT CARBON MIN 20% 0.1W V.MTG
R308		RF155DJO	150K CARBON FILM RESISTOR 5% 0.25W AXIAL
R310		RF183DJO	1K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
R311		RF563DJO	5K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR312		RQ105AL1	100K PRESET POT CARBON MIN 20% 0.1W V.MTG
R313/314		RF474DJO	47K CARBON FILM RESISTOR 5% 0.25W AXIAL
R314	(1241/AS)	RF155DJO	150K CARBON FILM RESISTOR 5% 0.25W AXIAL
R314	(1441/AL)	RF334DJO	33K CARBON FILM RESISTOR 5% 0.25W AXIAL
R315		RF225DJO	220K CARBON FILM RESISTOR 5% 0.25W AXIAL
R316		RF184DJO	18K CARBON FILM RESISTOR 5% 0.25W AXIAL
R316	(1241/AS)	RF394DJO	39K CARBON FILM RESISTOR 5% 0.25W AXIAL

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R317		RF563DJO	5K6 CARBON FILM RESISTOR 5% 0.25W AXIAL
R317	(1241/AS)	RF154DJO	15K CARBON FILM RESISTOR 5% 0.25W AXIAL
R318		RF184DJO	18K CARBON FILM RESISTOR 5% 0.25W AXIAL
R318	(1241/AS)	RF274DJO	27K CARBON FILM RESISTOR 5% 0.25W AXIAL
R320		RF330DJO	3R3 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR321		RS103PL2	1K PRESET POT CARB MIN WW/H.MTG 20% 4W
R322		RF332JJO	330R CARBON FILM RESISTOR 5% 1W AXIAL
R323		RF100DJO	1R0 CARBON FILM RESISTOR 5% 0.25W AXIAL
R323	(1441/AL)	RF333DJO	3R3 CARBON FILM RESISTOR 5% 0.25W AXIAL
R324		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R325		RF182JJO	180R CARBON FILM RESISTOR 5% 1W AXIAL
R326		RF152GJO	150R CARBON FILM RESISTOR 5% 0.5W AXIAL
R327		RF331DJO	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
VR328		RQ222AL2	220R PRESET POT CARB MIN 20% 0.1W H.MTG
R801		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R802		RL102GJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R803/804		RF224GJO	22K CARBON FILM RESISTOR 5% 0.5W AXIAL
R805		RF183DJO	1K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR806		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R807		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR808		RQ473AL2	4K7 CARBON POT CARB MIN MTG 20% 0.1W
R809		RF331DJO	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
R810		RF103DJO	10K CARBON FILM RESISTOR 5% 0.25W AXIAL
R811		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R811	(1441) (1442)	RF331DJO	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
R812		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R813		RL102GJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R814/815		RF224GJO	22K CARBON FILM RESISTOR 5% 0.5W AXIAL
R816		RF183DJO	1K8 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR817		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R818		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
R819		RF331DJO	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
VR820		RQ473AL2	4K7 PRESET POT CARB MIN H MTG 20% 0.1W
R821		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R822		RL103GJO	⚠ 1K FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R822	(1441/AL) (1441/AS) (1441/MS (1442 ALL MODELS) (1241/AS)	RL102GJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.25W AXIAL
R823/824		RF224GJO	22K CARBON FILM RESISTOR 5% 0.5W AXIAL
R825		RF183DJO	1K8 CARBON FILM RESISTOR 5% 0.5W AXIAL
VR826		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R827		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR828		RQ473AL2	4K7 PRESET POT CARB MIN H MTG 20% 0.1W
R829		RF331DJO	33R CARBON FILM RESISTOR 5% 0.25W AXIAL
R830/831/832 833		RK222GKO	220R CARBON COMP RESISTOR 10% 0.5W AXIAL
R833	(1441/AL) (1441/AS) (1441/MS) (1442 ALL MODELS) (1486/LI2U) (1449/AS) (1241/AS) (1446/LF) (1446/Li2)	RK105GKO	100K CARBON COMP RESISTOR 10% 0.5W AXIAL

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
R834		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
R835		RF475DJO	470K CARBON FILM RESISTOR 5% 0.25W AXIAL
R836		RK825GKO	820K CARBON COMP RESISTOR 10% 0.5W AXIAL
VR837		RQ226CL2	2M2 PRESET POT CARB H MTG 20% 0.15W
R838		RF185JJO	180K CARBON FILM RESISTOR 5% 1W AXIAL
R840		RF155JJO	150K CARBON FILM RESISTOR 5% 1W AXIAL
VR901		RQ103AL1	1K PRESET POT CARB MIN H MTG 20% 0.1W AXIAL
R901		RF103DJO	1K CARBON FILM RESISTOR 5% 0.25W AXIAL
R902		RF223DJO	2K2 PRESET POT CARB MIN H MTG 20% 0.1W AXIAL
VR902		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR903		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R904		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R905		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR906		RQ473AL2	4K7 PRESET POT CARB MIN H MTG 20% 0.1W
R907		RL102GJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.5W AXIAL
R908		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR910		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R911		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R912		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R913		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR914		RQ473AL2	4K7 PRESET POT CARB MIN H MTG 20% 0.1W
R915		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR916		RQ103AL2	1K PRESET POT CARB MIN H MTG 20% 0.1W
R917		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R918		R0154LJO	15K METAL OXIDE RESISTOR 5% 2W AXIAL
R920		RF223DJO	2K2 CARBON FILM RESISTOR 5% 0.25W AXIAL
VR921		RQ473AL2	4K7 PRESET POT CARB MIN H MTG 20% 0.1W
R922		RL102GJO	⚠ 100R FUSIBLE METAL FILM RESISTOR 5% 0.5W AXIAL
R923		RF472DJO	470R CARBON FILM RESISTOR 5% 0.25W AXIAL
R924-926		RK222GKO	220R CARBON COMP RESISTOR 10% 0.5W AXIAL
R927		RK105GKO	100K CARBON COMP RESISTOR 10% 0.5W AXIAL
R928		RF475DJO	470K CARBON FILM RESISTOR 5% 0.25W AXIAL
R931		RK825GKO	820K CARBON COMP RESISTOR 10% 0.5W AXIAL
VR932		RQ226CL2	2M2 PRESET POT CARBON H MTG 20% 0.15W
R933		RF155JJO	150K CARBON FILM RESISTOR 5% 1W AXIAL
R933		RF185JJO	180K CARBON FILM RESISTOR 5% 1W AXIAL
R934		RF185JJO	180K CARBON FILM RESISTOR 5% 1W AXIAL
R934		RF225JJO	220K CARBON FILM RESISTOR 5% 1W AXIAL
R935		RF474JJO	47K CARBON FILM RESISTOR 5% 1W AXIAL
R936		RL102GJO	⚠ 100R FUSIBLE METAL RESISTOR 5% 0.5W AXIAL
R937		RF273DJO	2K7 CARBON FILM RESISTOR 5% 0.25W AXIAL
C1		CX225NL6	⚠ 220nF 250V AC MET POLY CLASS X CAP 20% RADIAL
C2/3		CY103NL6	⚠ 1000pF 250V AC CERAMIC DISC CAPACITOR CLASS Y 20% RADIAL
C4			AS C1
C5		CD472YL6	470pF 2KV CERAMIC CAPACITOR 20% RADIAL
C6		CM104TL6	10nF 630V MET POLY CAPACITOR 20% RADIAL
C7		CD472YL6	470pF 2KV CERAMIC CAPACITOR 20% RADIAL
C8			AS C6
C10		CM564RK6	56nF 400V POLY CAPACITOR 20% RADIAL
C10	(1496/LI2U)		
	(1486/LI2U)	CM105NL6	100nF POLY CAPACITOR 20% RADIAL
C11		CA108RM7	100uF 385V ALUM ELECT CAPACITOR - 20+50% RADIAL
C11		CA288QM7	220uF 385V ALUM ELECT CAPACITOR - 20+50% RADIAL
C12		CA476HM6	4.7uF 35V ALUM ELECT CAPACITOR - 20+50% RADIAL
C13/14		CM105RL6	100nF 400V MET POLY CAPACITOR 20% RADIAL
C15		CD473KK6	4700pF 100V CERAMIC CAPACITOR 20% RADIAL

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
C16		CR104MKO	10nF 160V POLYSTYRENE CAPACITOR 2.5% AXIAL
C17		CL223XJ6	⚠ 2200pF 2000V POLYPROPYLENE CAPACITOR 5% RADIAL
C18		CA106JLO	1uF 50V ALUM ELECT CAPACITOR 20% AXIAL
C20		CY103NL6	⚠ 1000pF 250V AC CERAMIC DISC CAPACITOR CLASS Y 20% RADIAL
C21		CM105RL6	100nF 400V POLY CAPACITOR 20% RADIAL
C22		CD223FL6	2200pF 25V CERAMIC CAPACITOR 20% RADIAL
C23		CA476HM6	4.7uF 35V ALUM ELECT CAPACITOR - 20+50% RADIAL
C24		CM105NL6	100nF 250V MET POLY CAPACITOR 20% RADIAL
C25		CD472RL6	470pF 400V CERAMIC CAPACITOR 20% RADIAL
C26-28		CA477NM6	47uF 250V ALUM ELECT CAPACITOR - 20+50% RADIAL
C30		CD472RL6	470pF 400V CERAMIC CAPACITOR 20% RADIAL
C31		CA478FM6	470uF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C32,33		CM105ML6	100nF 160V POLY CAPACITOR 20% RADIAL
C34		CA228FM6	220uF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C101, 102		CA107FM6	10uF ALUM ELECT CAPACITOR - 2+50% RADIAL
C103, 104		CM105ML6	100nF 160V POLY CAPACITOR 20% RADIAL
C105			AS C101
C106		CM225KL6	220nF 100V MET POLY CAPACITOR 20% RADIAL
C201/202		CD102FL6	100pF 25V CERAMIC CAPACITOR 20% RADIAL
C203		CM475KL6	470nF 100V MET POLY CAPACITOR 20% RADIAL
C204		CM225KL6	220nF 100V MET POLY CAPACITOR 20% RADIAL
C205		CM105ML6	100nF 160V MET POLY CAPACITOR 20% RADIAL
C206		CA685JLO	680nF 50V ALUM ELECT CAPACITOR 20% AXIAL
C207		CA476HM6	4.7uF 35V ALUM ELECT CAPACITOR - 20+50% RADIAL
C208		CM104TL6	10nF 630V MET POLY CAPACITOR 20% RADIAL
C210		CP473GGO	4700pF 30V POLYSTYRENE CAPACITOR 2.5% AXIAL
C211		CM105ML6	100nF 160V POLY CAPACITOR 20% RADIAL
C212		CA228FM6	220uF 25V ALUM ELECT CAPACITOR - 20+50% RADIAL
C213		CM474NK6	47nF 250V MET POLY CAPACITOR 20% RADIAL
C214/215		CM105NL6	100nF 250V MET POLY CAPACITOR 20% RADIAL
C216/217		CD104YL6	10nF 2KV CERAMIC CAPACITOR 20% RADIAL
C218		CL335KN6	⚠ 0.33uF 250V POLYPROPYLENE CAP 10% RADIAL
C220		CM104TL6	10uF 630V MET POLY CAPACITOR 20% RADIAL
C221		CM475RL6	470nF 400V MET POLY CAPACITOR 20% RADIAL
C222		CL753XJ6	⚠ 7500pF 1500V POLYPROPYLENE CAP 5% RADIAL
C222	(ALL 1441, 1442 MODELS)		
	(1446/LF)		
	(1446/LI2)		
	(1451/MQ3)	CL563YJ6	5600pF 2000V POLYPROPYLENE CAP 5% RADIAL
C222	(1241/AS)	CL333XJ6	3n3 2000V POLYPROPYLENE CAP 5% RADIAL
C222	(1241/AT)	CL473YJ6	4700pF 2000V POLYPROPYLENE CAP 5% RADIAL
C223		CM684XK6	68nF 1500V POLY CAPACITOR 20% RADIAL
C224		CA109IN7	1000uF 40V ALUM ELECT CAPACITOR - 20+50% RADIAL
C225		CD561RL6	56pF 400V CERAMIC CAPACITOR 20% RADIAL
C301		CM225KL6	220nF 100V MET POLY CAPACITOR 20% RADIAL
C302		CM105NK6	100nF 250V POLY CAPACITOR 20% RADIAL
C303		CM155KK6	150nF 100V MET POLY CAPACITOR 20% RADIAL
C304		CA108HM6	100uF 35V ALUM ELECT CAPACITOR - 20+50% RADIAL
C305/306			AS C302
C306	(1241/AS)		
	(1241/AT)	CM225KL6	220nF 100V MET POLY CAPACITOR 20% RADIAL
C307		CD122RL6	120pF 400V CERAMIC CAPACITOR 20% RADIAL
C308		CA107FM6	10uF 25V ALUM ELECT CAP - 20+50% RADIAL
C310		CM105NK6	100nF 250V POLY CAPACITOR 20% RADIAL
C311		CA478HM6	470uF 35V ALUM ELECT CAP - 20+50% RADIAL
C312		CA228FM6	220uF 25V ALUM ELECT CAP - 20+50% RADIAL

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
C801		CM105NL6	100nF 250V METAL POLYESTER CAPACITOR 20% RADIAL
C802/804/806		CP271GGO	27pF 30V POLYSTYRENE CAPACITOR 2.5% AXIAL
C803/805/807		CP561GGO	56pF 30V POLYSTYRENE CAPACITOR 2.5% AXIAL
C808		CD104YL6	10nF 2KV CERAMIC CAPACITOR 20% RADIAL
C810		CM105NL6	100nF 250V METAL POLYESTER CAPACITOR 20% RADIAL
C811		CD104YL6	10nF 1-2KV CERAMIC CAPACITOR 20% RADIAL
C901		CM105NL6	100nF 250V METAL POLYESTER CAPACITOR 20% RADIAL
C902,904,906		CP271GGO	27pF POLYSTYRENE CAPACITOR 2.5% AXIAL
C903,905,907		CP122GG1	120pF POLYSTYRENE CAPACITOR 2.5% AXIAL
C910,911		CD104YL6	10nF 2KV CERAMIC CAPACITOR 20% RADIAL
C913		CM105NL6	0.1uF 250V METAL POLYESTER CAPACITOR 20%
D1-4		DP4007UMO	POWER RECTIFIER DIODE IN4007 MOTOROLA AXIAL
D5		DP4005UMO	POWER RECTIFIER DIODE IN4005 MOTOROLA AXIAL
D6		DF0157UEO	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D7		DF0159UEO	FAST RECOVERY DIODE BA159 MOTOROLA AXIAL
D8, 10-14		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D11-13		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D15,16		DP4002UMO	POWER RECTIFIER DIODE IN4002 MOTOROLA AXIAL
D17		DF0159UEO	FAST RECOVERY DIODE BA159 MOTOROLA AXIAL
D18		DZ88750FCO	ZENER DIODE BZY88C7V5 400mW 5% AXIAL
D20		DZ79331FCO	ZENER DIODE BZX79C33V 400mW 5% AXIAL
D21		DP4002UMO	POWER RECTIFIER DIODE IN4002 MOTOROLA AXIAL
D22		DF0159UEO	FAST RECOVERY DIODE BA159 MOTOROLA AXIAL
D23		DF0818UMO	FAST RECOVERY DIODE MR818 MOTOROLA AXIAL
D24		DF0157UEO	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D25,116		DP4002UMO	POWER RECTIFIER DIODE IN4002 MOTOROLA AXIAL
D101-107		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D108,110,111		DZ79560FCO	ZENER DIODE BZX79C5V6 400mW 5% AXIAL
D108,110,111	(1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/MS4) (1431/BS) (1431/LS1) (1431/MB4) (1431/MZ3) (1431/MZ4) (1431/MR4) (1435/MS) (1436/LS1) (1436/MS4) (2030/CS5) (1439/AS) (1439/MS4) (1439/MS) (1451AP/DS) (1449/AS)	DZ79430FCO	ZENER DIODE BZX79C4V3 400mW 5% AXIAL
D117		DZ79121FCO	ZENER DIODE BZX79C12V 400mW 5% AXIAL
D118			AS D108
D201		DF0157UEO	FAST RECOVERY DIODE BA157 MOTOROLA AXIAL
D301		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D302		DP4005UMO	POWER RECTIFIER DIODE IN4005 MOTOROLA AXIAL
D801-803		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D804		DZ79750FC1	ZENER DIODE BZX79C75 400mW 5% AXIAL

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
D804	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1442)		
	(1449/AS)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1241/AT)	DZ88750FCO	DIODE BZY88C7V5
D805-808		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D901-906		DS4148UTO	SMALL SIGNAL DIODE IN4148 THOMPSON AXIAL
D907		DZ79750FC1	ZENER DIODE BZX79C7V5 400mW 5% AXIAL
D907	(1496/LI2U)		
	(1439/AS)		
	(1439/MS)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1436/LS1)		
	(1436/MS4)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1456/LI2)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1451/DS)		
	(1451/MS4)		
	(1451/MQ3)		
	(1451/AS)	DZ88750FCO	ZENER DIODE BZY88C7V5 400mW 5% AXIAL
D908			AS D805
F1/F2		KA2001BAO	⚠ FUSE 2AMP (20mm) TIME DELAY

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
F2	(2031/AX) (2032/AM) (1431/AS) (1432/AS) (1431AP/MS4) (1431AP/DS) (1439/AS) (1439/MS) (1451/AS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1451/DS) (1241/AS) (1446/LF) (1446/LI2) (1456/LI2) (1241/AT)	KA2001BAO	⚠ FUSE 2AMP (20mm) TIME DELAY
F3	(2031/AX) (1431/AS) (1432/AS) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1439/MS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1451/AS) (1451/MS) (1451AP/MS4) (1451/DS) (1446/LF) (1449/AS) (1241/AS) (1446/LF) (1446/LI2) (1456/LI2) (1241/AS)	KA1001BQO	⚠ FUSE 1AMP (20mm) FAST BLOW
FH1 A/B	A/B	KS0001Y01	FUSE CLIP-PCB MTG (5mm)

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
FH1A/B,FH2A/B	(2030/CS5) (2031/CS5) (2031/AX) (2032/AM) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1439/MS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1451/AS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1451/DS) (1449/AS) (1456/LI2) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	KS0003Y01	FUSEHOLDER L222/K
FH3A/B	(1496/LI2U) (1486/LI2U)	KS0006Y01	FUSE CLIP-PCB MTG (6.3mm)

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
FH3A/B	(2031/CS5) (2031/AX) (2032/AM) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1451/AS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1451/DS) (1449/AS) (1456/LI2) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	KS0001Y01	FUSE CLIP-PCB MTG (5mm)
HARNESS		A00584I01	TB - NO. 1 (4 LEADS) BR, OR, W, Y.
HARNESS		A00585I01	TB - NO. 2 (8 LEADS)
HARNESS	(2031/CS5) (1449/AS)	A00815I01	TB - NO. 1 (4 LEADS) BR, OR, W, Y.
HARNESS	2031/CS5)	A00816I01	TB - NO. 2 (8 LEADS)
HARNESS	(1441/AL)	A00104I01	TB - NO. 1 (4 LEADS)
HARNESS	(1441/AL)	A00179I01	TB - NO. 2 (8 LEADS)
IC1		IV7812MX3	VOLTAGE REGULATOR 1C 78M12
IC1 (HEATSINK)		HH0003HAO	HEATSINK 1 STAVER TYPE V6-2L
IC101		IT74136MM2	OR/TTL LOGIC SN74LS136N
IC102		IV7805LXO	VOLTAGE REGULATOR IC "!" 78L05
IC201		IL1180PS2	LINEAR BI-POLAR IC TDA 1180P PLASTIC DIL S.G.S.
IC301		IL1170SS2	LINEAR BI-POLAR IC TDA 1170S PLASTIC DIL S.G.S.
IC301 (HEATSINK)		HH0001HCO	HEATSINK STAVER V8-800
L2		LW473UA6	CHOKE WIRE ENDED 10uH PC3774

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
L2	(1496/LI2U) (2030/CS5) (2031/CS5) (2031/AX) (2032/AM) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1439/MS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1486/LI2U) (1451/AS) (1451/DS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1449/AS) (1456/LI2) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	LW104UA7	CHOKE WIRE ENDED 10uH PC5640
L201		LW154SK2	CHOKE WIRE ENDED 15uH B78108-T1153-K
L202		LV001UA5	COIL WIDTH PC3398
L203		LN002UA5	COIL LINE LINEARITY PC5580
L204		LW104UA7	CHOKE WIRE ENDED 10uH PC5640
L801-804	(1441/AL) (1441/AS) (1441/MS) (1442) (1446/LF) (1446/LI2) (1241/AT)	LW154SK2	CHOKE 15uH B78108-T1153-K
L801		LW154VA5	CHOKE WIRE ENDED 15VH PC3391
L802		LW104VA4	CHOKE WIRE ENDED 10VH PC2677
L803/804		LW104VA4	CHOKE WIRE ENDED 10VH PC2677
L901		LW154UA5	CHOKE WIRE ENDED 15uH PC3391

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
L901	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1439/MS)		
	(1451/AS)		
	(1451/MS4)		
	(1451/MQ3)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1451/DS)		
	(1456/LI2)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)	LW154SK2	CHOKE WIRE ENDED 15uH B78108-T1153-K
L924		LW154UA5	15uH (IN SERIES WITH R924)
	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/M23)		
	(1431/M24)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1439/MS)		
	(1451/AS)		
	(1451/MS4)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1451/DS)		
	(1451/MQ3)		
	(1456/LI2)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)	LW154SK2	CHOKE 15uH B78108-T1153-K

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
L925		LW154UA5	15uH (IN SERIES WITH R925)
	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1439/MS)		
	(1441/MS4)		
	(1451AP/MS4)		
	(1451/MS4)		
	(1451/MQ3)		
	(1451AP/DS)		
	(1451/DS)		
	(1456/LI2)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)	LW154SK2	CHOKE 15uH B78108-T1153-K
L926		LW154UA5	15uH (IN SERIES WITH R926)
L926	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1439/MS)		
	(1441/MS4)		
	(1451AP/MS4)		
	(1451/MS4)		
	(1451/MQ3)		
	(1451AP/DS)		
	(1451/DS)		
	(1456/LI2)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)	LW154SK2	CHOKE 15uH B78108-T1153-K

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
LK1-5,7,8 10-18,20-22		WL2214TU1	WIRE LINK 5mm x 14mm x 5mm
LK23	(2031/AX)		
	(2032/AM)		
	(1451/AS)		
	(1451/DS)	WL2214TU1	WIRE LINK 5mm x 14mm x 5mm
PL1		KP0220D06	6 PIN INLINE PLUG PCB MTG SHROUDED PRESSAC 220/1546
PL1	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1439/AS)		
	(1439/MS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(1486/LI2U)		
	(1451/AS)		
	(1451/MS)		
	(1451/DS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1456/LI2)		
	(1241/AS)		
	(1446/LF)		
	1446/L12)		
	(1241/AT)	KP0300D06	6 PIN INLINE PLUG PCB MTG SHROUDED LOCKABLE, PRESSAC 320/3766
PL2		KP0025A03	PLUG 3 WAY 20/3443
PL3		KP0220D05	5-2 PIN INLINE PLUG MTG SHROUDED PRESSAC 220/2145-2,4

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
PL3	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1439/MS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1486/LI2U)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1456/LI2)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1241/AT)	KP0300D05	5-2 PIN INLINE PLUG MTG SHROUDED LOCKABLE, PRESSAC 320/3765
PL101		KP0026A10	10 PIN INLINE PLUG PCB MTG SHROUDED PRESSAC 20/3450
PL102		KP0025A05	5-2 WAY INLINE PLUG PCB MTG 20/3345
PL103		KP0025A10	10 PIN INLINE PLUG PCB MTG UNSHROUDED PRESSAC 20/3430
PL103			
	(2030/CS5)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1435/MS)		
	(1439/AS)		
	(1451AP/MS4)		
	(1449/AS)	KP0026A10	10 PIN INLINE PLUG PCB MTG SHROUDED PRESSAC 20/3450
PL201		KP0222D08 OR	8 PIN INLINE PLUG PCB MTG UNSHROUDED PRESSAC 220/1138
		KP0300D08	8 PIN INLINE PLUG PCB MTG UNSHROUDED LOCKABLE, PRESSAC 320/3768

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
T1			LINKS 2 x 14mm
T1A/1B		LM0001UA1	CHOKE (OREGA) 88545-00
T2		TI0004I06	TRANSFORMER SWITCH MODE ISOLATING PC5287 OR PC5307
T2	(1496/LI2U)		
	(1486/LI2U)	TL002SUO	TRANSFORMER SWITCH MODE ISOLATING PC3960
T201		TI0009I01	TRANSFORMER LINE DRIVER PC4163
T202		TI0003I01	⚠ TRANSDUCTOR EAST-WEST PC3396
T203		TI0007I01	TRANSFORMER LINE OUTPUT 14" PC3755
T203	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)	TI0016I01	TRANSFORMER LINE OUTPUT 20"
TH1	(1496/LI2U)		
	(1486/LI2U)	RT002QLO	THERMISTOR PTH45LC09-BG8ROH140
TH1	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1456/LI2)		
	(1241/AT)	RT005QNO	THERMISTOR 263100P2332T333

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TH2	(1496/LI2U)		
	(2030/CS5)		
	(2031/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1439/AS)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(1486/LI2U)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1456/LI2)		
	(1241/AT)	RT003NNO	THERMISTOR 15 OHMS 30% K231

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TL101-106			
	(2030/CS5)		
	(2031/AX)		
	(2032/AM)		
	(1431AP/MS4)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(1486/LI2U)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1456/LI2)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1241/AT)	KP0024A03	3-WAY PLUG 20/3423

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TL101,103-106	(2031/AX) (2032/AM) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1486/LI2U) (1451/AS) (1451/DS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1449/AS) (1241/AS) (1446/LF) (1446/LI2) (1456/LI2) (1241/AT)	KS7859I02	SOCKET-SHORTING 7859-02
TL102	(1486/LI2U) (1435/MS) (1446/LI2)	KL4838Z02	TEST LINK 10/4838 PRESSAC

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TL102A/B, 201A/B	(2030/CS5) (2031/AX) (2032/AM) (1431AP/MS4) (1431AP/DS) (1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1435/MS) (1436/LS1) (1436/MS4) (1439/AS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1451/AS) (1451/DS) (1451/MS) (1451AP/MS4) (1451AP/DS) (1449/AS) (1456/LI2) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	KM3070Y01	PIN TEST 10/3070 PRESSAC

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TL201	(2031/CS5)		
	(2032/AM)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(1486/LI2U)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS)		
	(1451AP/MS4)		
	(1451AP/DS)		
	(1449/AS)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1456/LI2)		
	(1241/AT)	KL4838Z02	LINK TEST 10/4838 PRESSAC
TL201A/B			
	(2031/CS5)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1436/LS1)		
	(1436/MS4)		
	(1441/MS4)		
	(1449/AS)	KM3070Y01	PIN TEST 10/3070 PRESSAC
TL202-2		WL2210TU1	WIRE LINK 5mm + 10mm + 5mm
TL901		KM3070Y01	PIN TEST 10/3070 PRESSAC
TL901		KL4838Z02	LINK TEST 10/4838 PRESSAC
TL901		KM0006Y01	PIN TURRET 10/006 PRESSAC
TL901A/B			
	(1435/MS)	KM3070Y01	PIN TEST 10/3070 PRESSAC
TL901A/B			
	(1435/MS)	KL4838Z02	LINK TEST 10/4838 PRESSAC
TR1		QS0307UM5	PNP SILICON TRANSISTOR BC307-5 MOTOROLA

COMPONENTS PARTS LIST - SECTION 2

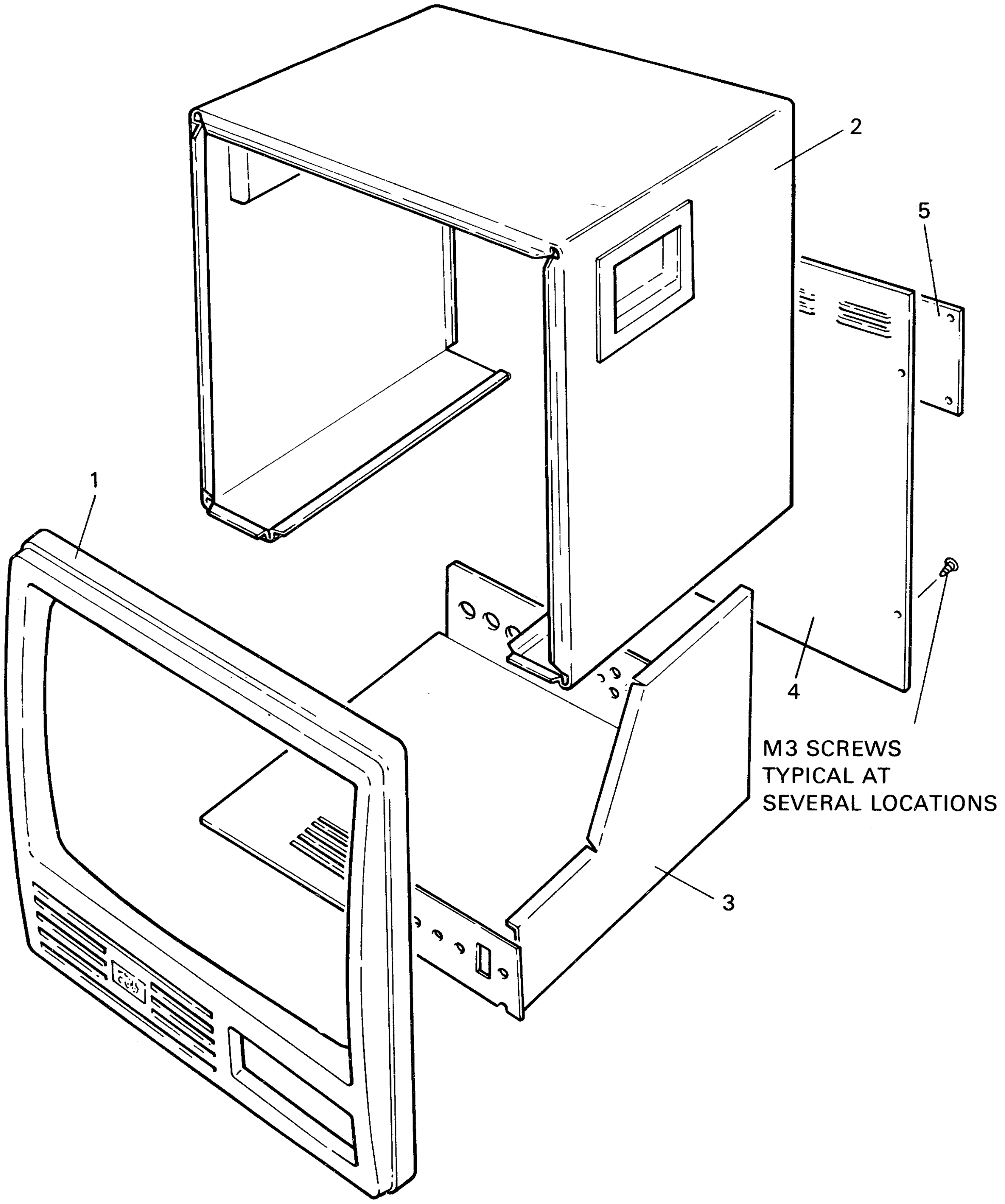
COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TR2		QT003AXO	NPN DARLINGTON TRANSISTOR TIPL 753A (R3213)
	(1496/LI2U)		
	(1431AP/MS4)		
	(1431AP/DS)		
	(1431/AS)		
	(1432/AS)		
	(1431/BS)		
	(1431/LS1)		
	(1431/MZ3)		
	(1431/MZ4)		
	(1431/MB4)		
	(1431/MR4)		
	(1431/MS4)		
	(1431/DS)		
	(1435/MS)		
	(1436/LS1)		
	(1436/MS4)		
	(1439/AS)		
	(1441/AL)		
	(1441/AS)		
	(1441/MS)		
	(1441/MS4)		
	(1451/AS)		
	(1451/DS)		
	(1451/MS4)		
	(1451AP/MS4)		
	(1451/MQ3)		
	(1451AP/DS)		
	(1456/LI2)		
	(2032/AM)		
	(1486/LI2U)		
	(1449/AS)		
	(1241/AS)		
	(1446/LF)		
	(1446/LI2)		
	(1241/AT)	QP0753UXO	NPN TRANSISTOR TIPL753A (R3213)
HEATSINK		A00007102	LCCD HEAT SINK (SMPSU) ASSEMBLY
TR2	HEATSINK	M00205I01	HEATSINK REDPOINT TV3 SPECIAL
TR16		QS0500UMO OR	NPN SILICON POWER TRANSISTOR MOTOROLA BU500
		QS0500VXO	NPN SILICON POWER TRANSISTOR TEXAS BU500
TR16			
HEAT SINK		A00008102	LCCD HEAT SINK (LOPT) ASSEMBLY
TR101		QS0337UTO	NPN SILICON TRANSISTOR BC337-5 MOTOROLA
TR102		QS4123UMO	NPN SILICON TRANSISTOR 2N4123 MOTOROLA
TR103-105		QS4125UM5	PNP SILICON TRANSISTOR 2N4125 MOTOROLA
TR106		QS0337UTO	NPN SILICON TRANSISTOR BC337-5 MOTOROLA
TR201		QS0460UMO	NPN SILICON TRANSISTOR BF460-5 MOTOROLA
TR201			
HEATSINK		M00305I01	HEATSINK REDPOINT TV3 SPECIAL
TR202		QS0500UMO	NPN TRANSISTOR SIL BU500
TR202			
HEATSINK		M00205I01	HEATSINK REDPOINT TV3 SPECIAL
TR301			AS TR106
TR801,804,806 901,903,905		QS0392UMO	NPN SILICON TRANSISTOR BF392 MOTOROLA
TR801-804			
	(1441, 1442)		
	(1449/AS)	QS0393WT1	TRANSISTOR BF393 W1

COMPONENTS PARTS LIST - SECTION 2

COMP REF	MODEL NO.	PART NO.	COMPONENT DESCRIPTION
TR802,805,807 902,904,906		QS0787UM1	NPN SILICON TRANSISTOR BF787-5 MOTOROLA
TR802,805,807 902,904,906	(1431/AS) (1432/AS) (1431/BS) (1431/LS1) (1431/MZ3) (1431/MZ4) (1431/MB4) (1431/MR4) (1431/MS4) (1431/DS) (1436/LS1) (1436/MS4) (1486/LI2U) (1435/MS) (1439/AS) (1441/AL) (1441/AS) (1441/MS) (1441/MS4) (1449/AS) (1241/AS) (1446/LF) (1446/LI2) (1241/AT)	QS0869UAO	NPN SILICON TRANSISTOR BF869-5 MOTOROLA
TR802,805		QS0869UAO	*TRANSISTOR BF869
TR803,907		QS4123UMO	NPN SILICON TRANSISTOR 2N4123 MOTOROLA
TR806		QS0393WT1	*TRANSISTOR BF393 W1
TR807	(1441) (1442) (1241/AS)	QS0869UAO	TRANSISTOR BF869
TR902,904,906	(1431AP/MS4) (1431AP/DS) (1496/LI2U) (1451/AS) (1451/DS) (1451/MS4) (1451AP/MS4) (1451/MQ3) (1451AP/DS) (1456/LI2) (2031/CS5) (2031/AX) (2032/AM)	QS0869UAO	NPN SILICON TRANSISTOR BF869-5 MOTOROLA
TRIPLER		ET001QA1	TRIPLER BG1897
TY1,2		QY0103UMO	THYRISTOR BR 103 MOTOROLA AXIAL
PCB		BC0029I06	MAIN PCB ASSEMBLY SERIES 3 (6)

MECHANICAL
PARTS LISTING

MECHANICAL PARTS LISTING

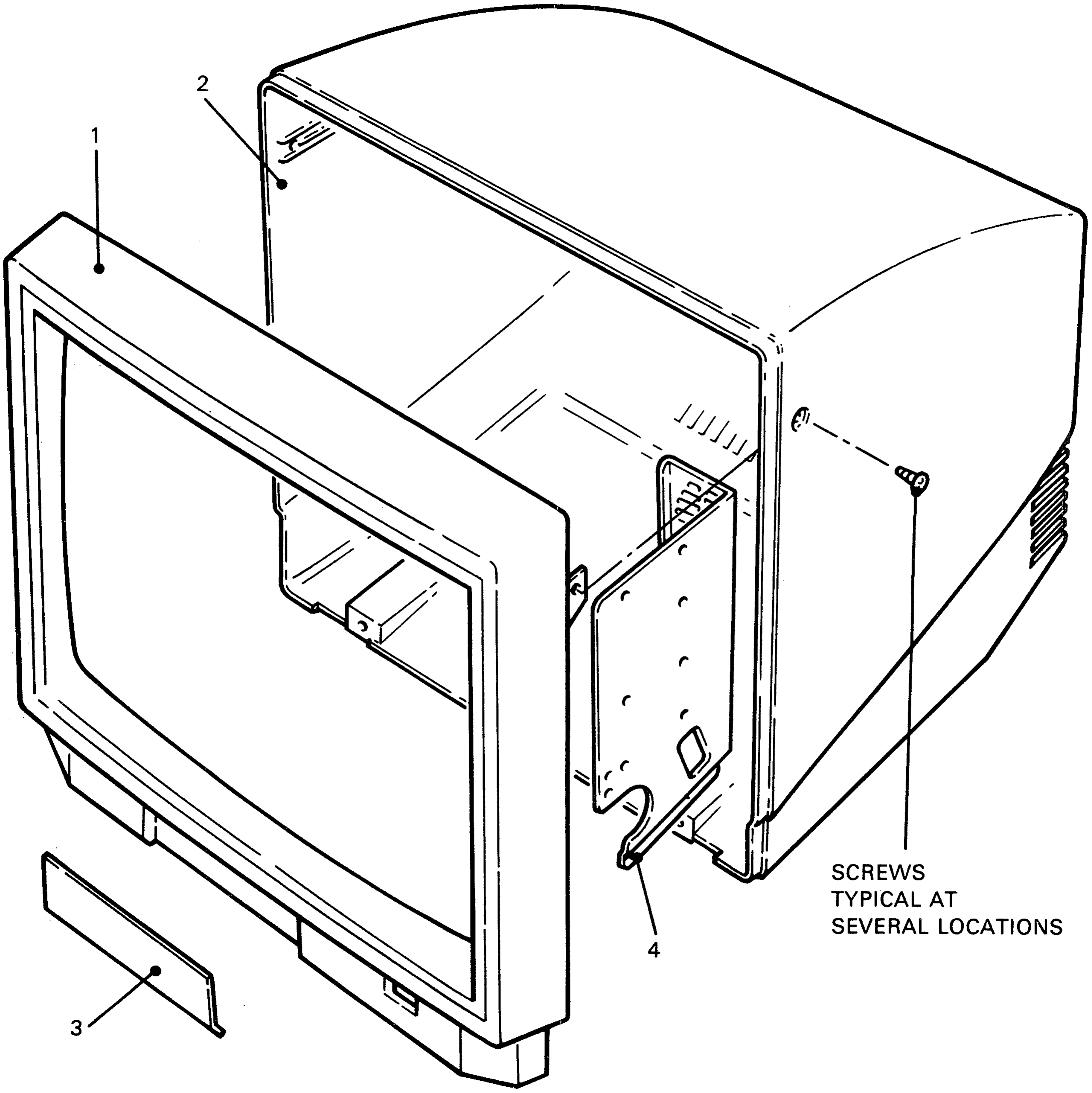


C SERIES CABINET - 20 INCH MODEL

This cabinet is an all-metal, rugged construction, incorporating carrying handles fitted on each side.

C SERIES CABINET COMPONENT PARTS

IDENT NO.	PART NO.	DESCRIPTION
1	PC0136I03	FACIA, CABINET BEZEL
2	MC0137I04	CABINET TOP/SIDE ASSEMBLY
2	MC0150I03	CABINET TOP/SIDE ASSEMBLY (INCL. SPEAKER)
3	M00235I02	CABINET BASE ASSEMBLY
4	MC0139I01	CABINET BACK ASSEMBLY
5	PC0140I01	BLISTER, FITTED TO CABINET BACK



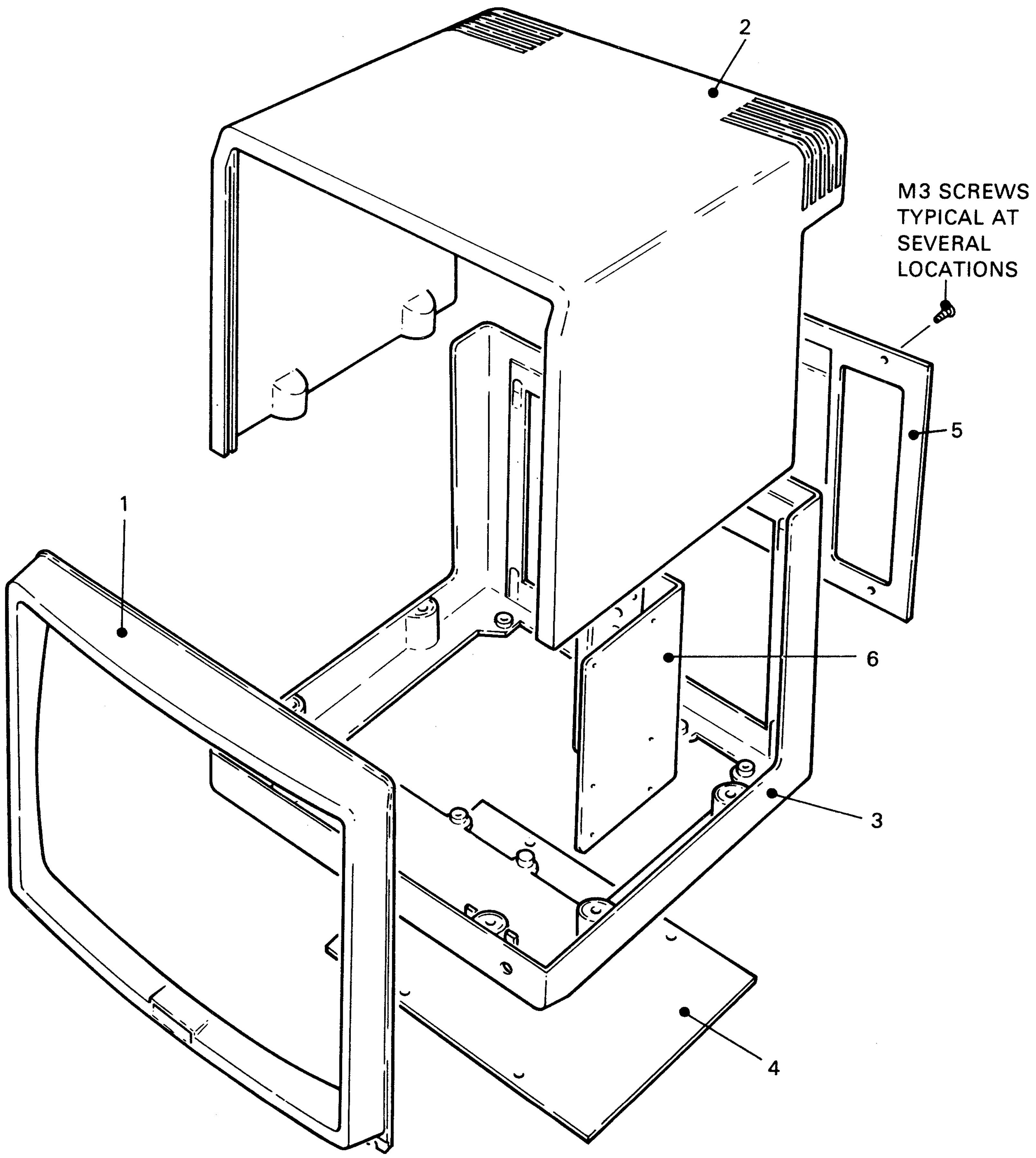
D SERIES CABINET - 14 INCH MODEL

This cabinet is injection moulded, and is one of the latest designs offered in the MICROVITEC CUB monitor range and is available in different colours.

D SERIES CABINET COMPONENT PARTS

IDENT NO.	PART NO.	DESCRIPTION
1	PC0124I01	FACIA, CABINET BEZEL
2	PC0125I01	CABINET
3	PC0126I01	HINGED DOOR
4	M00221I04	INPUT BRACKET ASSEMBLY (METAL)

MECHANICAL PARTS LISTING



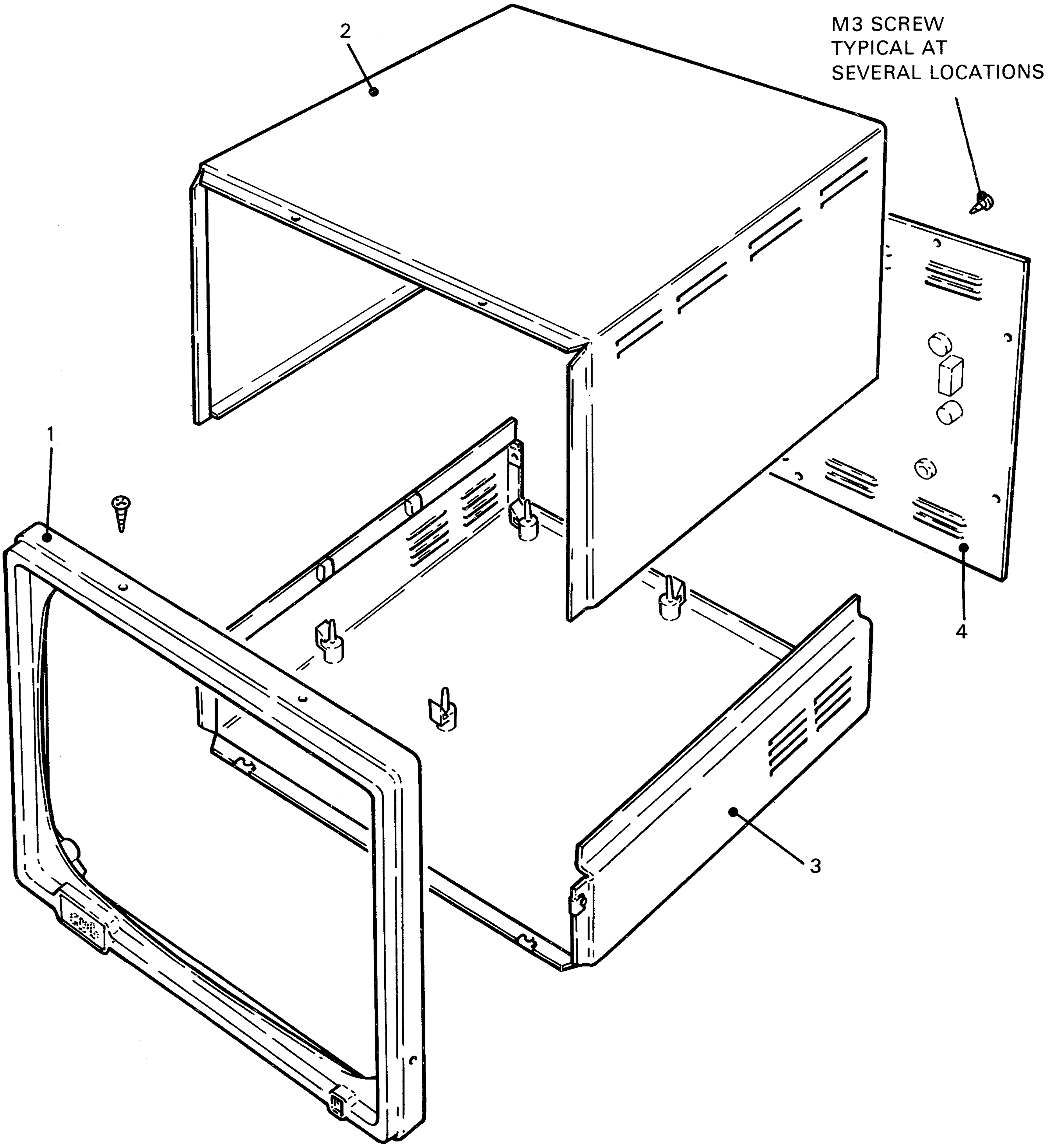
L SERIES CABINET - 14 INCH MODEL

This cabinet is constructed of high density structural foam. A modern compact design, available in different colours.

L SERIES CABINET COMPONENT PARTS

IDENT NO.	PART NO.	DESCRIPTION
1	PC0103I05	FACIA, CABINET BEZEL
2	PC0104I02	CABINET TOP/SIDE ASSEMBLY
3	PC0107I02	CABINET BASE ASSEMBLY (MOULDED)
4	P00308I01	CABINET BASE PANEL (MOULDED)
5	PC0105I01	CABINET BACK ASSEMBLY
6	M00141I03	INPUT AND CONTROLS BRACKET ASSEMBLY (METAL)

MECHANICAL PARTS LISTING


2
M3 SCREW
TYPICAL AT
SEVERAL LOCATIONS
1
4
3

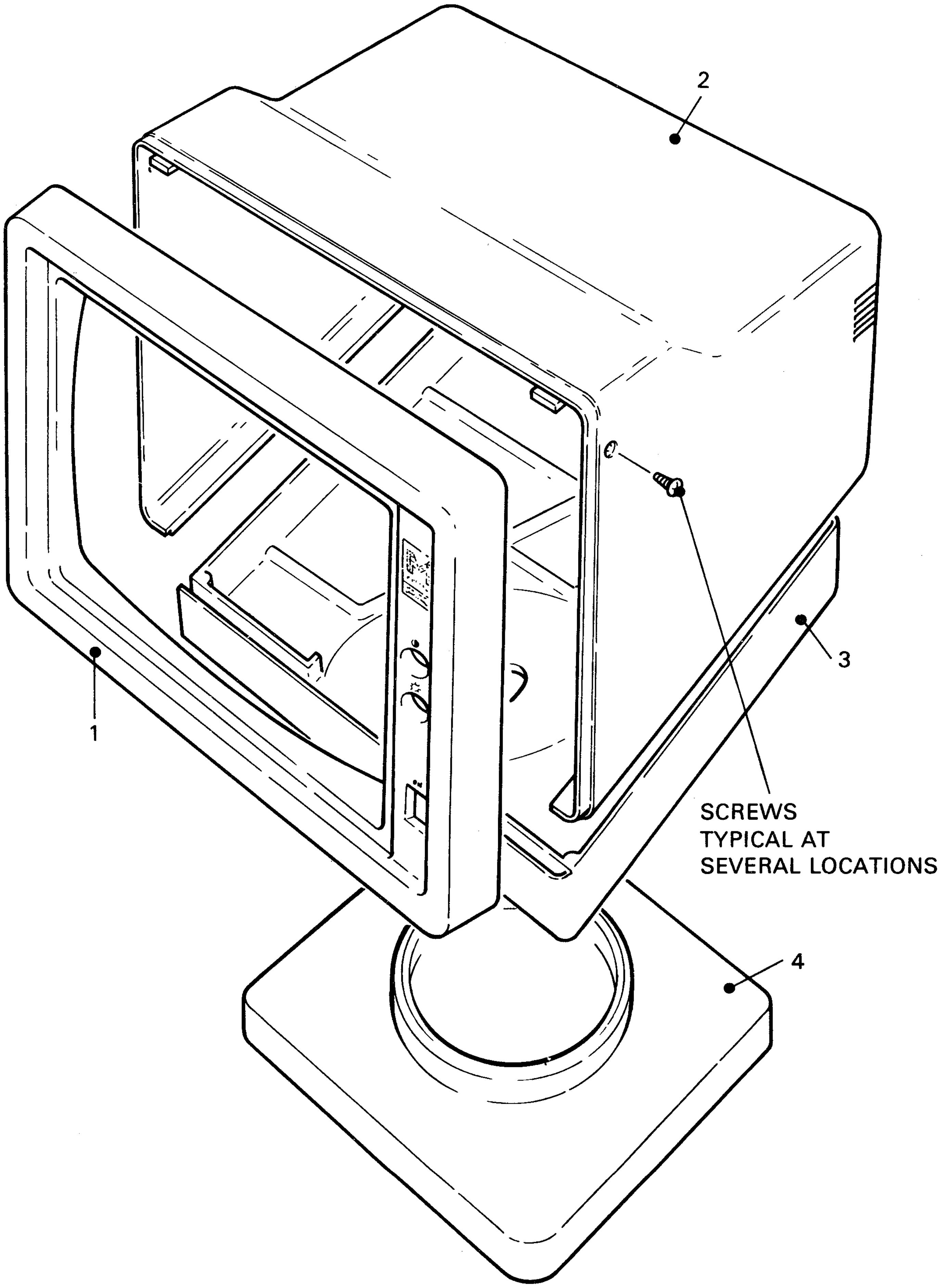
M SERIES CABINET - 14 AND 20 INCH MODEL

This cabinet is an all-metal, rugged construction. The 20 inch model was deleted from production in December 1983.

M SERIES CABINET COMPONENT PARTS

IDENT NO.	PART NO.	DESCRIPTION
1	MC0066I04	FACIA, CABINET BEZEL
2	MC0021I05	CABINET TOP/SIDE ASSEMBLY
3	MC0019I03	CABINET BASE ASSEMBLY
4	MC0094I03	CABINET BACK ASSEMBLY

MECHANICAL PARTS LISTING


2
3
1
SCREWS
TYPICAL AT
SEVERAL LOCATIONS
4

T SERIES CABINET - 14 INCH MODEL

A foam polyurethane moulded cabinet incorporating a swivel base assembly.

T SERIES CABINET COMPONENT PARTS

IDENT NO.	PART NO.	DESCRIPTION
1	PC5047I02	FACIA, CABINET BEZEL MOULDING
2	PC5046I01	CABINET COVER MOULDING
3	PC5045I01	CABINET BASE MOULDING
4	PC5044I01	CABINET PLINTH MOULDING

TRIPLE STANDARD
PAL INTERFACE

TRIPLE STANDARD - PAL INTERFACE

GENERAL

The Triple Standard - PAL Interface Assembly' is designed to interface between the Series 3 main chassis PCB assembly and the host system. It is designed to accept RS170 video signals (0.7v p-p video + 0.3v p-p mixed - Ve Sync into 75R). In wire-frame chassis format, output connections from interface to main chassis PCB are made via hard-wired flexible leads and multiway plug-in connectors PL102 and PL103, located on the main chassis.

On some models, an interface input wiring harness lead assembly is provided. This is supplied with one end only of the harness terminated in a 17-way connector, the opposite wire ends being unterminated. Circuit details and connections for this harness lead assembly are given in the accompanying diagram - '17-Way Harness Connections' and 'Table of Options'.

DOUBLE STANDARD/TRIPLE STANDARD INPUTS

Depending on how the interface assembly is installed, input modes for either double or triple standards may be accommodated as follows:

1. TTL and PAL Video Mode - Double Standard
2. TTL, 1 volt 75 ohm and PAL Video Mode - Triple Standard

1. Double Standard Input

When wired as indicated in the diagram - 'TTL' and 'PAL Video' Modes are accommodated. Either one of these two modes may be selected by a 'single pole change-over' switch as shown in the diagram.

2. Triple Standard Input

Wiring details to accommodate Triple-Standard inputs and the various input options are given in the '17-Way Harness Connections' Diagram and the accompanying 'Table of Options'. Suitable additional switching may be incorporated to accommodate the various options, depending on user requirements.

OPERATIONAL NOTES

1. PAL/Sync Input

When this input (PL1-pin 16) is used as the separate sync input of a 1v/75R R.G.B. + sync video source, the amplitude of the sync MUST BE between 0.2v p-p and 0.7v p-p, nominally 0.3v peak to peak. If the amplitude exceeds these values, an 'In-Line' B.N.C. attenuator must be used.

2. Sync-On Green Option

Setting Plug Link 'TL1' on the PAL Interface PCB to 'Position 2', allows a 'sync-on-green' 1V/75R RGB Video Source to be used.

NB: Note that the 'Green' 1V/75R video input (PL1-pin 12) now also becomes the PAL input.

See wiring diagram and 'Table of Options'.

BRIGHTNESS CONTROL LIMIT

If required - a resistor of 5K6 ohms 0.25W - may be incorporated in series with the 'brightness' control to limit the control's range of 'brightness' variation - as shown in the diagram.

AUDIO STAGE

On some versions of the interface, either single channel or twin channel audio amplifier stages may be incorporated, depending on model and specification.

Inputs and outputs for the audio stage(s) are marked as left-hand channel (L) and right-hand channel (R) and are terminated in 2-pin connectors. Normally, only a single channel audio stage is provided in most applications.

Audio input to the stage may be fed across a 47k 'gain control' pot, with the slider taken to the audio stages input.

TYPICAL AUDIO SPECIFICATIONS

Typical specifications for the audio amplifier stage are as follows:

Input impedance:	47 k nominal
Input sensitivity:	100 mV typical
Output:	2 watts max @ 1kHz into 16 ohms

TABLE OF OPTIONS				
Connector		**Available Standards**		
Pin No.	**Wire Colour Coding**	**TTL**	**1V/75R**	**PAL**
10	Brown	O/C	0V (S/C)	0V (S/C)
15	Mauve	*	> 0.7V < 12V (O/C)	0V (S/C)
17	Pink	0V (S/C)	> 10.5V < 12V (O/C)	> 10.5V < 12V (O/C)

NOTES:

* = Not Critical (May be 0V to 12V or O/C)

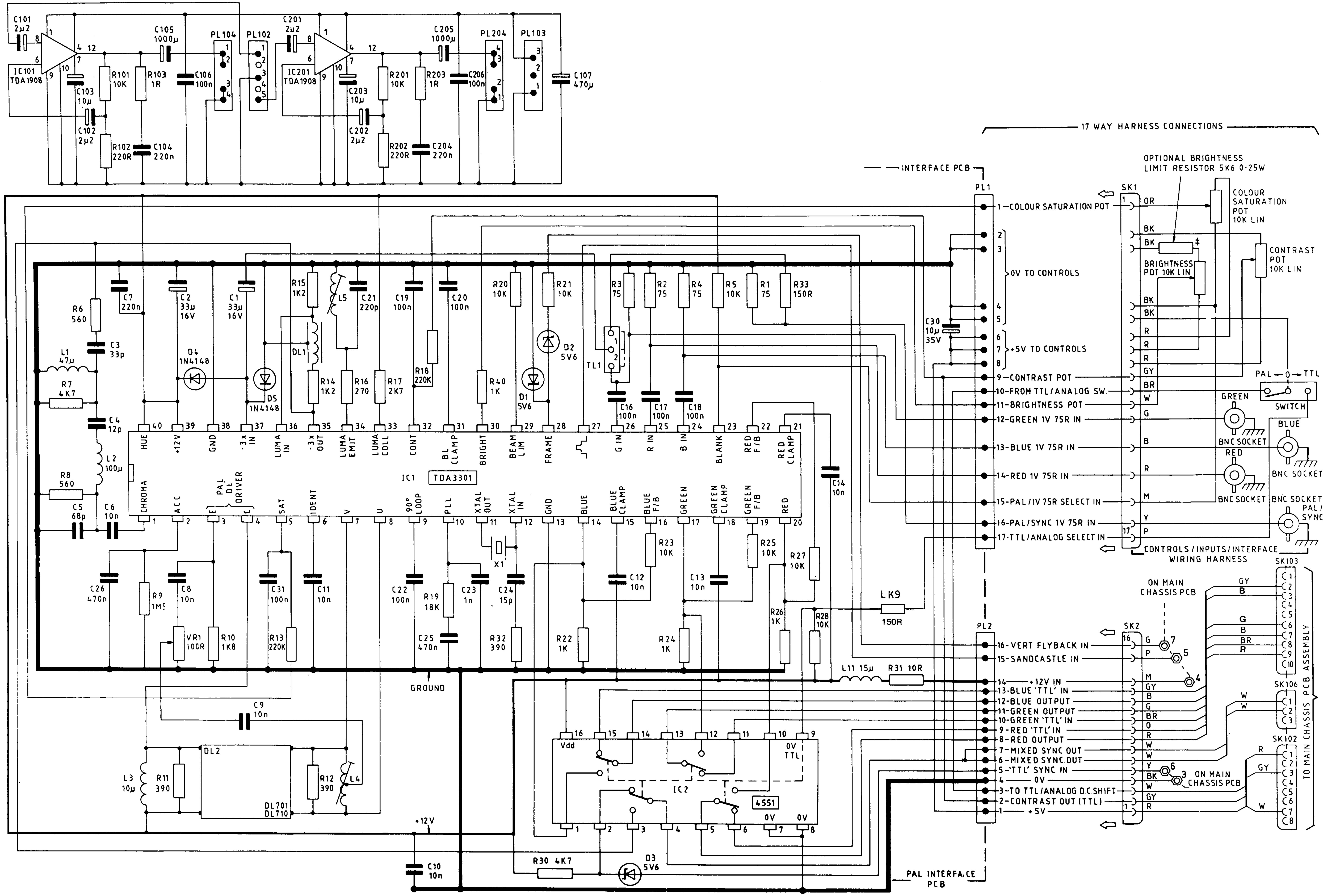
O/C = Open Circuit (No connection)

S/C = Short Circuit (< 10 R) to 0V (Ground)

PARTS LIST

Circuit Reference	Component Reference	Component Description
RESISTORS		
R5, 20, 21, 23, 25, 27, 28	RF104DJ0	RESISTOR C/F 10K ¼W 5%
R6, 8	RF562DJ0	RESISTOR C/F 560R ¼W 5%
R7, 30	RF473DJ0	RESISTOR C/F 4K7 ¼W 5%
R9	RF156DJ0	RESISTOR C/F 1M5 ¼W 5%
R10	RF183DJ0	RESISTOR C/F 1K8 ¼W 5%
R11, 12	RF392DJ0	RESISTOR C/F 390R ¼W 5%
R13, 18	RF225DJ0	RESISTOR C/F 220K ¼W 5%
R14, 15	RF123DJ0	RESISTOR C/F 1K2 ¼W 5%
R16	RF272DJ0	RESISTOR C/F 270R ¼W 5%
R17	RF273DJ0	RESISTOR C/F 2K7 ¼W 5%
R19	RF184DJ0	RESISTOR C/F 18K ¼W 5%
R22, 24, 26	RF103DJ0	RESISTOR C/F 1K0 ¼W 5%
R31	RL101DJ0	RESISTOR M/FUS, 10R ¼W 5%
R32	RF392DJ0	RESISTOR C/F 390R ¼W 5%
R33	RF152DJ0	RESISTOR C/F 150R ¼W 5%
R40	RF103DJ0	RESISTOR C/F 1K0 ¼W 5%
R101, 201	RF104DJ0	RESISTOR C/F 10K ¼W 5%
R102, 202	RF222DJ0	RESISTOR C/F 220R ¼W 5%
R103, 203	RF100DJ0	RESISTOR C/F 1R0 ¼W 5%
VR1	RQ102AL2	POT PRESET 100R 0.1W H7
CAPACITORS		
C1, 2	CA337EN6	CAPACITOR ALUM/ELEC 33µF 16V
C3	CK331JJ0	CAPACITOR CERAMIC/T 33pF 50V
C4	CK121JK0	CAPACITOR CERAMIC/T 12pF 50V
C5	CK681JJ0	CAPACITOR CERAMIC/T 68pF 50V
C6, 8-15	CK104FL0	CAPACITOR CERAMIC/T 10nF 25V 20%
C7	CM225KK6	CAPACITOR MET/T 0.22µF 100V
C16, 17, 18, 19, 20, 27	CM105NL6	CAPACITOR MET/T 0.1µF 250V
C21	CK222JK0	CAPACITOR CERAMIC/T 220pF 50V
C22	CM105NL6	CAPACITOR MET/P 0.1µF 250V
C23	CK103JK0	CAPACITOR CERAMIC/T 1nF 50V
C24	CK151JK0	CAPACITOR CER/T 15pF 50V AXIAL
C25, 26	CM4758K6	CAPACITOR MET/P 470nF 63V
C30	CA107JL7	CAPACITOR A/ELEC 10µF 50V 20% RAD PR
C31	CA105NL6	CAPACITOR CERAMIC/T 100nF
C101, 102, 201, 202	CA2268M7	CAPACITOR A/ELEC 2.2µF 63V PREF
C103, 203	CA107JL7	CAPACITOR A/ELEC 10µF 50V 20% RAD PR
C104, 204	CM225KL6	CAPACITOR MET/P 0.22µF 100V
C105, 205	CA109HM6	CAPACITOR ALUM/ELEC 1000µF 35V
C106, 206	CM105NL6	CAPACITOR MET/P 0.1µF 250V
C107, 207	CA478FM7	CAPACITOR ALUM/ELEC 470µF 25V

Circuit Reference	Component Reference	Component Description
DIODES		
D1, 2, 3	DZ79560FR0	DIODE ZENER BZX79B5V6 2%
D4, 5	DS4148UT0	DIODE IN 4148 THOMSON
INTEGRATED CIRCUITS		
IC1	IL3301UM3	CIRCUIT INT. TDA3301 SELECTED
IC2	IG4551UM2	CIRCUIT INT. 4551
IC101, IC201	IL19080S2	CIRCUIT INT. TDA 1908
CHOKES & DELAY LINES		
L1	LW474SK2	CHOKE 47μH
L2	LW105SK2	CHOKE 100μH
L3	LW104SK2	CHOKE 10μH
L4, 5	LV001TA3	CHOKE KAN K2819XM
L11	LW154SK2	CHOKE 15μH B78108-T1153-K
DL1	ED0001P01	DELAY LINE DL470
DL2	ED0002P01	DELAY LINE DL711
CONNECTORS		
PL1	KP0026A17	PLUG 17-WAY 20/3457
PL2	KP0026A16	PLUG 16-WAY 20/3456
PL102	KP0025A05	PLUG 5-WAY 20/3445
PL103	KP0025A03	PLUG 3-WAY 20/3443
PL104	KP0025A04	PLUG 4-WAY 20/3444
TL1	KP0024A03	PLUG 3-WAY 20/3423
MISCELLANEOUS		
FIT TL1	KL9005Z02	LINK TEST MOLEX 90059-0009 P/O
X1	XC0014UU6	CRYSTAL IQD TYPE 'P' A124D
2 TRACK CUTS	BC0111I02	PCB PAL INTERFACE
LK1, 2, 3	WL2214TU1	WIRE LINK 5mm x 14mm x 5mm
LK6 7, 8	WL2212TU1	WIRE LINK 5mm x 12mm x 5mm
LK9, 10	WL2214TU1	WIRE LINK 5mm x 14mm x 5mm
LK12, 13	WL2212TU1	WIRE LINK 5mm x 12mm x 5mm
	A01647101	I/FACE ASSEMBLY TPL/STD - MC REV 3



IC101 TDA1908
IC201 TDA1908
C101 2µ2
C102 2µ2
C103 10µ
C104 220n
C105 1000µ
C106 100n
C107 470µ
R101 10K
R102 220R
R103 1R
C201 2µ2
C202 2µ2
C203 10µ
C204 220n
C205 1000µ
C206 100n
R201 10K
R202 220R
R203 1R
PL104
PL102
PL204
PL103
17 WAY HARNESS CONNECTIONS
INTERFACE PCB
PL1
1-COLOUR SATURATION POT
0V TO CONTROLS
+5V TO CONTROLS
9-CONTRAST POT
10-FROM TTL/ANALOG SW.
11-BRIGHTNESS POT
12-GREEN 1V 75R IN
13-BLUE 1V 75R IN
14-RED 1V 75R IN
15-PAL/1V 75R SELECT IN
16-PAL/SYNC 1V 75R IN
17-TTL/ANALOG SELECT IN
OPTIONAL BRIGHTNESS LIMIT RESISTOR 5K6 0·25W
SK1
COLOUR SATURATION POT 10K LIN
CONTRAST POT 10K LIN
BRIGHTNESS POT 10K LIN
PAL – 0 – TTL
SWITCH
GREEN
BLUE
RED
BNC SOCKET
PAL/SYNC
CONTROLS/INPUTS/INTERFACE WIRING HARNESS
C30 10µ 35V
IC1 TDA3301
CHROMA
ACC
PAL DL DRIVER
SAT
IDENT
V
U
90° LOOP
PLL
XTAL OUT
XTAL IN
GND
BLUE
BLUE CLAMP
BLUE F/B
GREEN
GREEN CLAMP
GREEN F/B
RED
HUE
+12V
-3x IN
LUMA IN
-3x OUT
LUMA EMIT
LUMA COLL
CONT
BL CLAMP
BRIGHT
BEAM LIM
FRAME
G IN
R IN
B IN
BLANK
RED F/B
RED CLAMP
R6 560
R7 4K7
R8 560
L1 47µ
L2 100µ
C3 33p
C4 12p
C5 68p
C6 10n
C7 220n
C2 33µ 16V
C1 33µ 16V
D4 1N4148
D5 1N4148
R15 1K2
R14 1K2
L5
DL1
C21 220p
R16 270
R17 2K7
C19 100n
C20 100n
R18 220K
R40 1K
R20 10K
R21 10K
D1 5V6
D2 5V6
TL1
R3 75
R2 75
R4 75
R5 10K
R1 75
R33 150R
C16 100n
C17 100n
C18 100n
C14 10n
C26 470n
R9 1M5
C8 10n
VR1 100R
R10 1K8
C31 100n
R13 220K
C11 10n
C22 100n
R19 18K
C25 470n
C23 1n
C24 15p
X1
R32 390
R22 1K
C12 10n
R23 10K
C13 10n
R24 1K
R25 10K
R27 10K
R26 1K
R28 10K
LK9 150R
GROUND
C9 10n
DL2
L3 10µ
R11 390
R12 390
L4
DL701 DL710
+12V
C10 10n
IC2 4551
Vdd
0V TTL
0V
R30 4K7
D3 5V6
L11 15µ
R31 10R
PL2
16-VERT FLYBACK IN
15-SANDCASTLE IN
14-+12V IN
13-BLUE 'TTL' IN
12-BLUE OUTPUT
11-GREEN OUTPUT
10-GREEN 'TTL' IN
9-RED 'TTL' IN
8-RED OUTPUT
7-MIXED SYNC OUT
6-MIXED SYNC OUT
5-'TTL' SYNC IN
4-0V
3-TO TTL/ANALOG DC SHIFT
2-CONTRAST OUT (TTL)
1-+5V
PAL INTERFACE PCB
SK2
ON MAIN CHASSIS PCB
SK103
SK106
SK102
TO MAIN CHASSIS PCB ASSEMBLY
OR
BK
R
GY
BR
W
G
B
M
Y
P
O

TRIPLE STANDARD - PAL INTERFACE CIRCUIT DIAGRAM

SPECTRUM INTERFACE CARD – DESCRIPTION/OPERATION

1. LUMINANCE CHANNEL (Y)

A. The (-Y) signal contains:

(1) Video information
(2) line sync pulses
(3) frame sync pulse

B. The incoming Y signal is attenuated by the potential divider, R16, R17 the resultant signal is then amplified by TR6.

C. Transistors TR7, TR8 and TR9 have the following functions:-

(1) TR7 - Seperates the sync pulses
(2) TR8 - Inverts the sync pulses
(3) TR9 - Buffers the sync pulses
R28 and R29 in the emitter of TR9, splits the voltage swing to produce a 'SYNC TTL' output.

D. The rising edge of the sync output signal is used by C6, R30 and TR24 to produce a pulse which has the same duration and timing as the colour burst gating pulse on the +/- (R-Y) signal.

E. The luminance signal on the collector of TR6, is clamped to the black level by C10 and TR25.

F. The black level is set by resistor/diode potential divider formed by VR1, (R36, R37, R65 and 2 IN4148 diodes).

2. COLOUR DIFFERENCE CHANNELS

A. The -(B-Y) Channel

(1) The -(B-Y) signal is attenuated by a potential divider network R32 and R34. TR10 inverts and amplifies to produce + (B-Y). TR11 and C9 use the sync pulses to clamp the + (B-Y) signal to the black level.
(2) TR21 merges + (B-Y) clamped signal to +Y clamped signal to produce the BLUE output.
(3) TR22, is an electronic switch that has its threshold set by R56 and R57.
(4) The gain of TR22 is set by R58 and R59 to produce TTL levels. TR23 emitter follows the TTL signal which produces a buffered output.

B. The +/- (R-Y) Channel

This channel is a phase alternating line (PAL) signal, which requires alternate lines, inverted to produce + (R-Y).

(1) The incoming +/- (R-Y) signal is A.C. coupled by C17, C1 and TR1 thus forming a unity gain, phase splitter.
(2) The non inverted output of TR1 drives an electronic switch (TR3). The inverted output of TR1 is buffered by TR2.
(3) The (R-Y) switch is enabled during the colour burst, gating pulse.
(4) A set/re-set flip-flop switch formed by IC 1C and IC 1D works in the following :-
    (a) SET - If next line of video is POSITIVE
    (b) RESET - If next line of video is NEGATIVE
(5) The outputs of IC1D enable bi-directional switches which will either:
    (a) Connect +(R-Y) through C1
    (b) Connect inverted -(R-Y) through C2.
    Thus producing +(R-Y), TR4 and TR5 clamp the +(R-Y) to the black level.
(6) The + (R-Y) clamped signal is added to the +Y clamped signal by TR13 to produce +R signal.
(7) TR14 has its threshold set by R43 and R42, the gain is set by R44 and R45, in order to produce TTL levels.
(8) TR15 emitter follows the TTL signal thus producing a buffered signal output.

C. THE (G-Y) OUTPUT

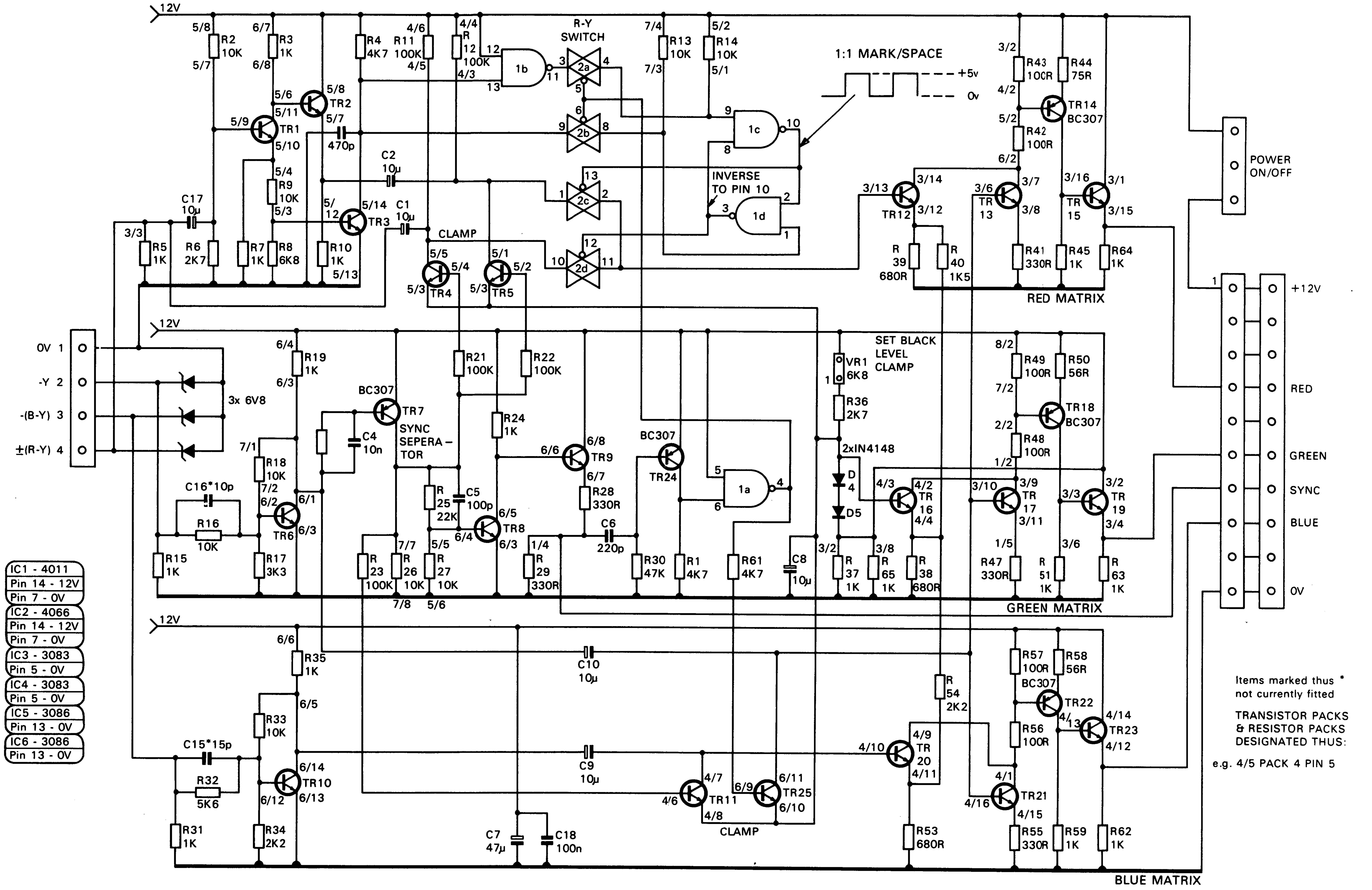
(1) This signal is generated by mixing the following:-
  (a) The (B-Y) clamped signal, TR16 performs this mixing function
  (b) The (R-Y) clamped signal, TR16 performs this mixing function

(2) The proportions of (B-Y) and (R-Y) clamped signals which are added together are set by R54 and R40.

(3) G OUTPUTS
  (a) This signal is produced by the addition of the following signals:-
    (i) (G-Y) clamped signal, TR17 performs this function.
    (ii) +Y clamped signal, TR17 performs this signal function.

(4) TR18 has its threshold set by R48 and R49, the gain is thus set by, R50 and R51 in order to produce suitable TTL levels.

(5) TR19 emitter follows the TTL signal and produces a buffered output.


12V
R-Y SWITCH
1:1 MARK/SPACE
+5v
0v
INVERSE TO PIN 10
CLAMP
POWER ON/OFF
RED MATRIX
GREEN MATRIX
BLUE MATRIX
SET BLACK LEVEL CLAMP
SYNC SEPERA-TOR
2xIN4148
3x 6V8
0V 1
-Y 2
-(B-Y) 3
±(R-Y) 4
+12V
RED
GREEN
SYNC
BLUE
0V
IC1 - 4011
Pin 14 - 12V
Pin 7 - 0V
IC2 - 4066
Pin 14 - 12V
Pin 7 - 0V
IC3 - 3083
Pin 5 - 0V
IC4 - 3083
Pin 5 - 0V
IC5 - 3086
Pin 13 - 0V
IC6 - 3086
Pin 13 - 0V
Items marked thus * not currently fitted
TRANSISTOR PACKS & RESISTOR PACKS DESIGNATED THUS:
e.g. 4/5 PACK 4 PIN 5
R2 10K
R3 1K
R4 4K7
R11 100K
R12 100K
R13 10K
R14 10K
R43 100R
R44 75R
R42 100R
TR14 BC307
TR1
TR2
TR3
470p
C2 10µ
C1 10µ
C17 10µ
R5 1K
R6 2K7
R7 1K
R8 6K8
R9 10K
R10 1K
TR4
TR5
TR12
TR13
TR15
R39 680R
R40 1K5
R41 330R
R45 1K
R64 1K
R19 1K
BC307 TR7
C4 10n
R21 100K
R22 100K
R24 1K
TR9
BC307 TR24
VR1 6K8
R36 2K7
D4
D5
R49 100R
R50 56R
TR18 BC307
R48 100R
TR16
TR17
TR19
R18 10K
C16*10p
R16 10K
TR6
R15 1K
R17 3K3
R25 22K
C5 100p
TR8
R28 330R
C6 220p
R23 100K
R26 10K
R27 10K
R29 330R
R30 47K
R1 4K7
R61 4K7
C8 10µ
R37 1K
R65 1K
R38 680R
R47 330R
R51 1K
R63 1K
R35 1K
C10 10µ
R57 100R
R58 56R
BC307 TR22
R54 2K2
R33 10K
C15*15p
R32 5K6
TR10
C9 10µ
TR11
TR25
TR20
TR21
TR23
R56 100R
R31 1K
R34 2K2
C7 47µ
C18 100n
R53 680R
R55 330R
R59 1K
R62 1K
1a
1b
1c
1d
2a
2b
2c
2d

SINCLAIR ZX SPECTRUM INTERFACE

IBM/APPLE
INTERFACE

'PROM' INTERFACE PANEL

GENERAL

1. The 'Programmable-read-only-memory' (PROM) interface panel is used with certain models in the 'SERIES-3' range of colour monitors. Two different versions of the panel assembly may be used – depending on model and intended country of operation.

2. **Basically, the two versions are very similar.**

   (1) Versions incorporating R.F.I. filtering networks (L/C components L1 to L3 & C4 to C6), are employed with certain models intended for use in countries other than the UK.

   (2) Versions without R.F.I. filtering are currently used for models operating in the U.K.

3. **Interface connections:**

   (1) When installed, this panel assembly interfaces between input connector PL101, located on 'SERIES-3' main chassis PCB and the monitor's 'user' 7-pin Din input socket.

   NOTE: The 'customer' contrast control VR111, shown on the 'SERIES-3' main chassis circuit diagram, is not fitted as shown when the PROM interface is used. In this case, the 'customer' contrast control pot is connected to 'PL2', located on the PROM interface panel.

   (2) The 'PROM-INTERFACE CONNECTION DIAGRAM' provides wiring interconnection details.

CIRCUIT DIAGRAM

1. The circuit diagram for the 'PROM INTERFACE PANEL' provides circuit details of the panel assembly. Component values are given in the accompanying LIST of COMPONENTS.

CIRCUIT DESCRIPTION

1. The purpose of the 'PROM' interface panel is to convert 4-Bit digital video signals, normally referred to as 'R.G.B. & Intensity', into Linear R.G.B. signals.

2. **Colour Combinations**

   (1) There are 16 possible colours which can be displayed (2^4 combinations).

   (2) IC2, a fusible link PROM, provides sixteen 8-bit outputs corresponding to one of the 16 addresses selected by the R.G.B. and intensity signals.
   These outputs use 3-bits for RED and GREEN, and 2-bits for BLUE video, hence; there are 8 levels of Red and Green and 4 levels of Blue available.

   (3) Resistors R3 to R10 and resistors R11 to R18 form potential dividers respectively between base and collector resistors of TR101, TR102, TR103, located on the 'SERIES-3' main PCB. Resistors values are selected to 'weight' respective PROM outputs, to 'least significant' and 'most significant' bits.

   NOTE: When the 'PROM interface Panel' is installed, the moveable links PL103, shown in the 'SERIES-3' main circuit diagram, should be fitted into linked POSITION (1).

3. **+5 Volt Supply**

   (1) IC1, C2 and C3 provides a regulated +5V supply for IC2.

4. **Protection & Termination**

   (1) Diodes D1 to D5 provide flash-over protection for IC2 and for computer signal 'in' sources.

   (2) Reistors R21 to R26 may be fitted on some models to terminate incoming digital signals.

5. **Contrast Control**

   (1) Transfer TR1, R1 and an external pot connected to PL2 provide for 'customer' control of contrast on some models.

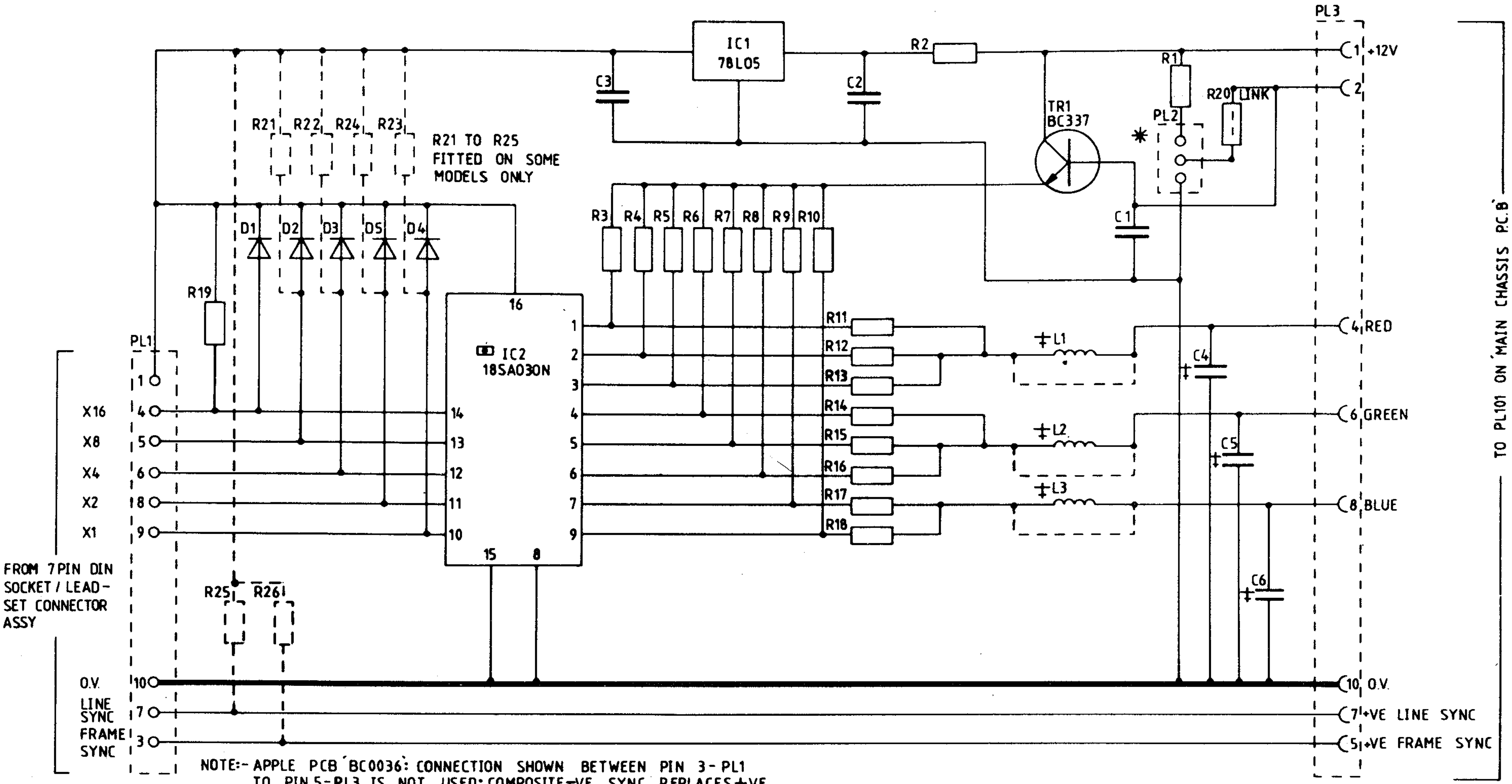
   (2) TR1 forms an emitter follower, the voltage at the emitter determining the video output amplitude on 'contrast'.

6. Sync Signals

(1) Sync signals are not required by the PROM circuitry and are passed directly through the interface panel.

7. R.F.I. Filtering

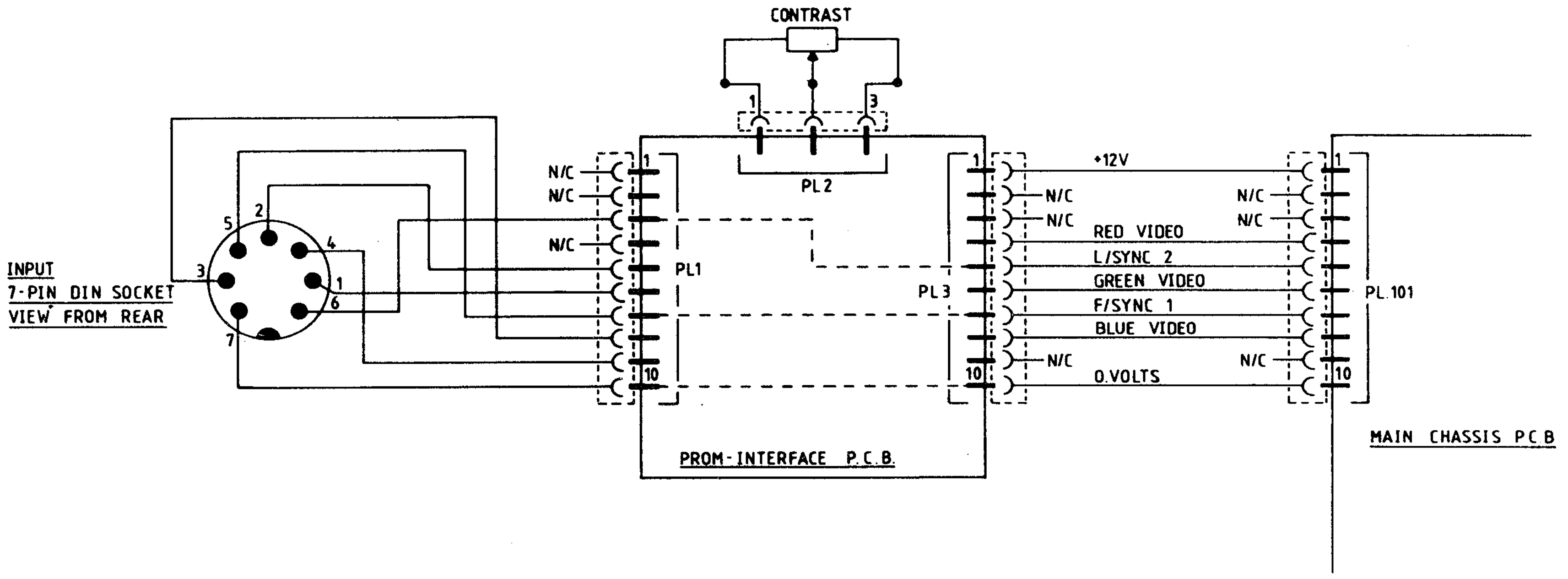
(1) On models requiring R.F.I. filtering, L/C networks formed by L1/C4, L2/C5 and L3/C6 are fitted on R, G & B outputs.

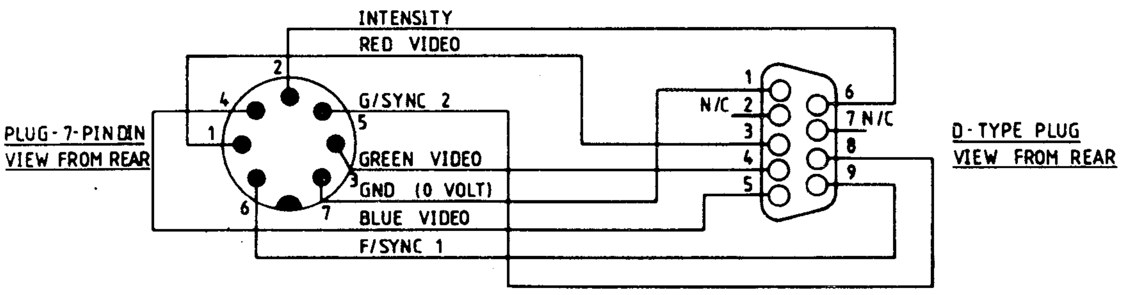

PL3
IC1
78L05
R2
C3
C2
R1
+12V
R20
LINK
TR1
BC337
PL2
✱
R21
R22
R24
R23
R21 TO R25
FITTED ON SOME
MODELS ONLY
D1
D2
D3
D5
D4
R3
R4
R5
R6
R7
R8
R9
R10
C1
R19
16
IC2
18SA030N
R11
R12
R13
R14
R15
R16
R17
R18
L1
L2
L3
C4
C5
C6
RED
GREEN
BLUE
TO PL101 ON 'MAIN CHASSIS P.C.B'
PL1
X16
X8
X4
X2
X1
14
13
12
11
10
15
8
1
2
3
4
5
6
7
9
FROM 7PIN DIN SOCKET / LEAD-SET CONNECTOR ASSY
R25
R26
O.V.
LINE SYNC
FRAME SYNC
O.V.
+VE LINE SYNC
+VE FRAME SYNC

NOTE:- APPLE PCB 'BC0036': CONNECTION SHOWN BETWEEN PIN 3 - PL1
TO PIN 5 - PL3, IS NOT USED: COMPOSITE -VE SYNC REPLACES +VE
'LINE SYNC' SHOWN ON PINS 7 TO 7 OF PL1-PL5

SYMBOL	REMARKS
▭	IC2 IS PROGRAMMED INDIVIDUALLY FOR SPECIFIC MONITOR MODEL Nº
✱	PL2 CONNECTS TO CUSTOMER CONTRAST CONTROL POT ASSY
⫲	FITTED ON RFI SUPPRESSED VERSIONS ONLY

CIRCUIT DIAGRAM 'PROM INTERFACE PANEL'


CONTRAST
1
2
3
PL2
INPUT
7-PIN DIN SOCKET
VIEW FROM REAR
N/C
N/C
N/C
PL1
1
10
PL3
1
10
N/C
N/C
+12V
RED VIDEO
L/SYNC 2
GREEN VIDEO
F/SYNC 1
BLUE VIDEO
N/C
O.VOLTS
N/C
N/C
N/C
PL.101
PROM-INTERFACE P.C.B.
MAIN CHASSIS P.C.B


INTENSITY
RED VIDEO
G/SYNC 2
GREEN VIDEO
GND (0 VOLT)
BLUE VIDEO
F/SYNC 1
PLUG-7-PIN DIN
VIEW FROM REAR
1
2
3
4
5
6
7
N/C
N/C
8
9
D-TYPE PLUG
VIEW FROM REAR

PROM INTERFACE - INTERCONNECTION
DIAGRAM - FOR 'SERIES 3' MONITORS
DRG Nº G00737

LIST OF COMPONENTS - PROM INTERFACE PANEL

GENERAL

1. Components used in the Prom Interface Panel Assemblies, together with possible component variations are listed following;
2. Details of possible circuit variations, used with different versions of the panel, are shown in the accompanying Prom Interface Circuit Diagram.

RESISTORS

1. Most of the resistors employed in the construction are standard carbon film types of 0.25 watt rating. ±5% tolerance.

LIST OF COMPONENTS - PROM INTERFACE

RESISTORS

Component Reference	Part No.	Component Description
R1	RF683DJO	RESISTOR C/F 6K8 0.25W 5%
R2	RF391GJO	RESISTOR C/F 39R 0.5W
R3,6,11,14,20,21,22,23,24,25,26	RF222DJO	RESISTOR C/F 220R 0.25W 5%
R4,7,10,12	RF472DJO	RESISTOR C/F 470R 0.25W 5%
R15,18	RF103DJO	RESISTOR C/F 470R 0.25W 5%
R5,8,13	RF103DJO	RESISTOR C/F 1KO 0.25W 5%
R16	RF683DJO	RESISTOR C/F 1KO 0.25W 5%
R9,17	RF102DJO	RESISTOR C/F 100R 0.25W 5%
R19		RESISTOR C/F 2K2 0.25W 5%

NOTE
FOR APPLE MONITORS ONLY; - RESISTOR C/F R9,R17 BECOMES 220R 0.25W 5%

CAPACITORS

C1	CA2268M6	CAPACITOR ALUM/ELEC 2.2UF 63V
C2,3	CM105ML6	CAPACITOR MET/P 0.1UF 160V
C4,5,6	CK151JKO	CAPACITOR CER/T 15PF 50V

DIODES, TRANSISTORS, INTEGRATED CIRCUITS

TR1	QS0337UTO	TRANSISTOR BC337-5
IC1	IV7805LXO	CIRCUIT INT. 78L05
IC2	IR18030AX2	PROM TBP 18SA030N (PROGRAMMED INDIVIDUALLY FOR SPECIFIC MODEL)
D1,2-5	DS4148UTO	DIODE IN4148 THOMPSON

CONNECTORS

PL1,3	KP0026A10	PLUG 10 PIN 20/3450 PRES
PL2	KP0025A05	PLUG 5 WAY 20/3445

INDUCTORS

L1,2,3	LW104SK2	CHOKE 10 UH

MODIFICATION FOR IBM/APPLE INTERFACES

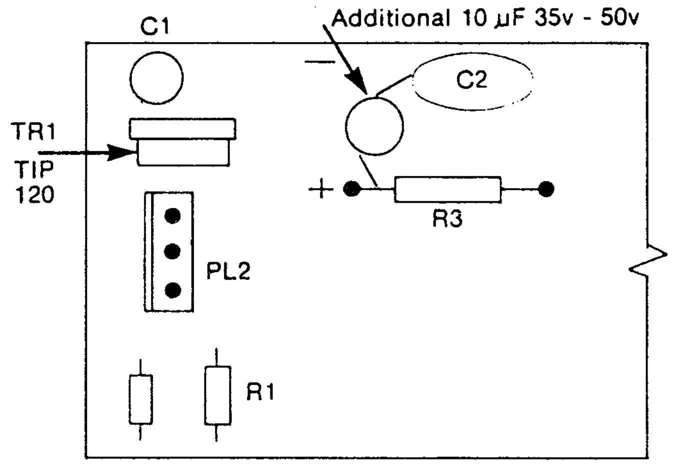
(1) Remove TR1 (BC337) and replace with TIP 120 as shown.

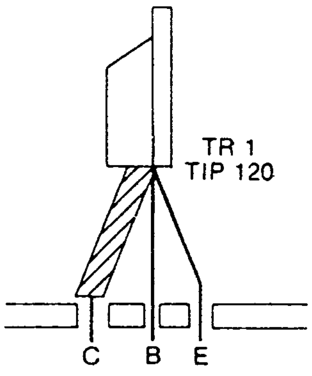
(2) Remove R1 (6 K8) and replace with 8K2 ¼ watt 5%.

(3) Place a 10 microfarad 35V electrolytic as follows:

   (i) negative side, to top of existing C4 position

   (ii) positive side, mechanically wrapped around and soldered to left side of R3.


C1
Additional 10 µF 35v - 50v
−
C2
TR1
TIP
120
+
R3
PL2
R1


TR 1
TIP 120
C
B
E

AMENDMENTS

AMENDMENTS

AFFECTS

All metal cabinet monitors.

DESCRIPTION

Modifications to bring cabinet back wire routing, dressing and securing in line with current production practice.

IMPLEMENTATION

These modifications only apply whenever a monitor is returned for service.

MODIFICATIONS

With the cabinet top removed check the following:

Signal Wires On Cabinet Back Components

(DIN sockets, BNC sockets, mode switches, brightness/contrast controls etc).

a) It is now the practice to fit a 'tyrap' fastener onto the signal wires on each component. (See diagrams). A 'tyrap' should be fitted to any component which is found not to have one.

Note: The signal wires are already mechanically twisted onto each pin and then soldered : this modification provides additional wire attachment.

b) If it is possible to move any of these signal wires away from its normal position to touch the small exposed section of the terminals on the main switch then sufficient 'tyraps' should be fitted to these wires to hold them in position.

Note: This does not apply to wires which are already contained within a secondary sleeve.

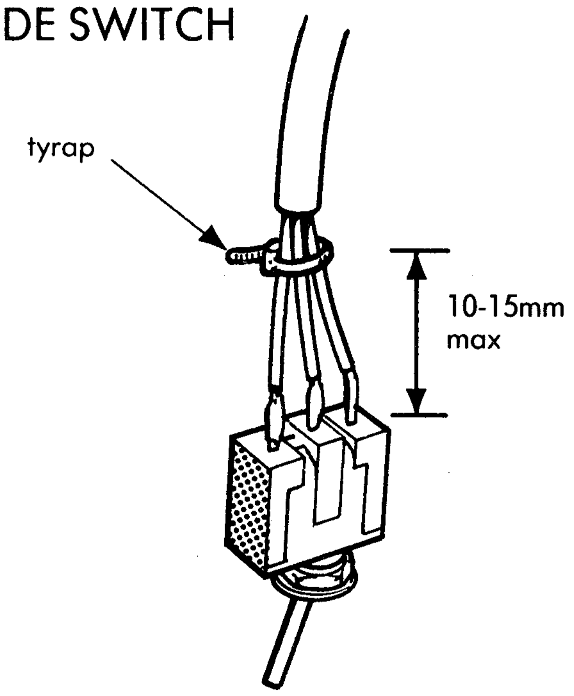
Single Insulated Mains Wires On Mains Switch

This only applies to the short sections of mains cable from which the outer sheath has been removed to allow the individual wires to be attached and soldered to the mains switch.

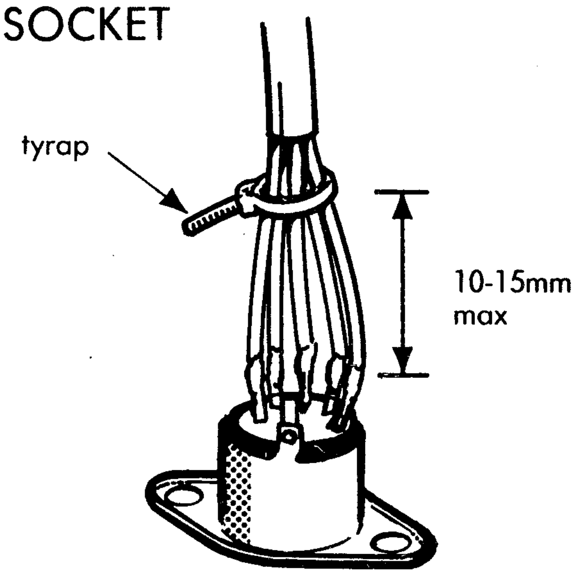
If it is possible to move any of these short sections of wire away from its normal position to touch a pin on one of the cabinet back components then sufficient 'tyraps' should be fitted to the mains wires to hold them in position. (See diagram).

TYRAP POSITIONS ON CABINET BACK COMPONENTS

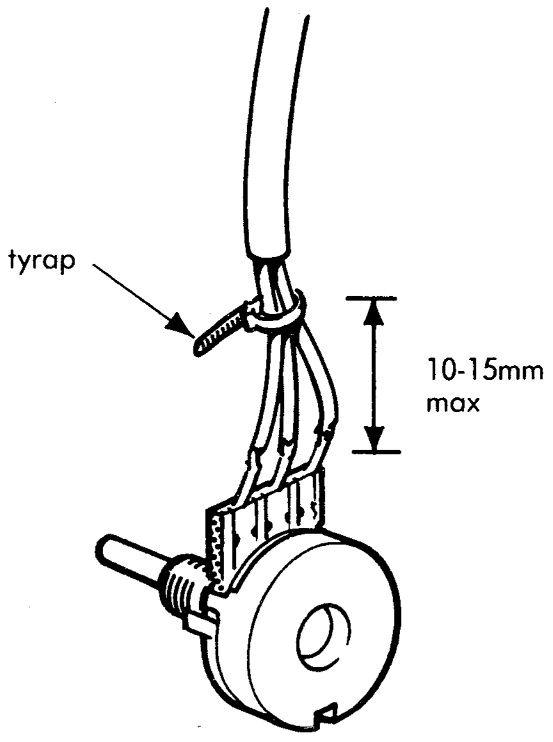
MODE SWITCH


tyrap
10-15mm
max

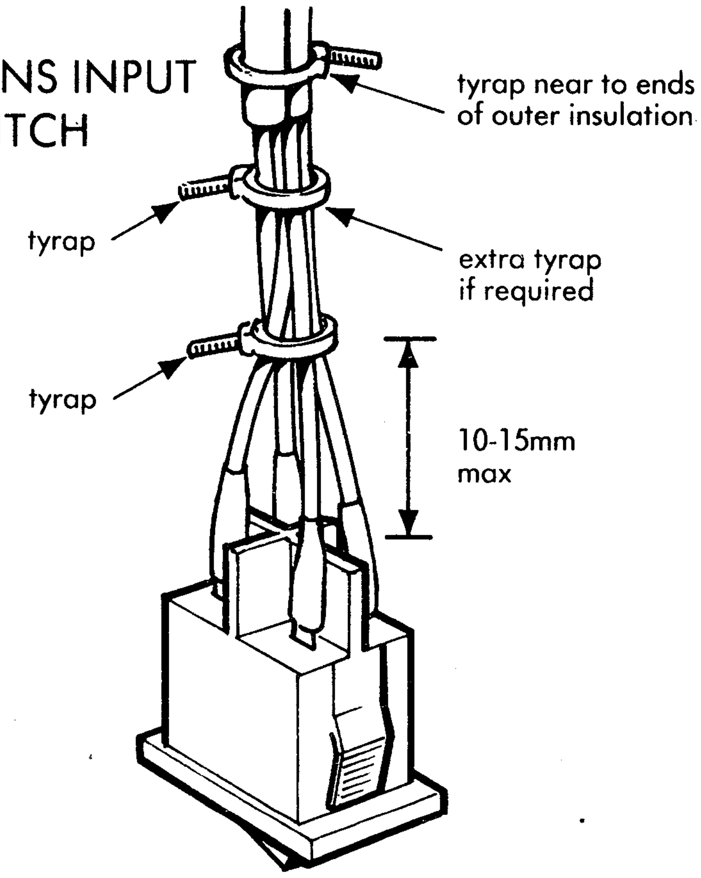
DIN SOCKET


tyrap
10-15mm
max

CONTROL


tyrap
10-15mm
max

MAINS INPUT SWITCH


tyrap near to ends of outer insulation
tyrap
extra tyrap if required
tyrap
10-15mm
max

Note: All tyraps to be fully tight